for . . .

engineers and contractors controlling the design, specification, installation and maintenance of heating, ventilating and air conditioning.

HEATING AND VENTILATING

The Air Conditioning Monthly

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THIS MONTH'S COVER

The large doors in plane factories constitute a heating problem. In the St. Louis plant of Curtiss-Wright Corp., shown, a long row of heaters above the doors blast hot air to cover the openings. Plant was designed by Albert Kahn Associated Architects and Engineers, Inc.

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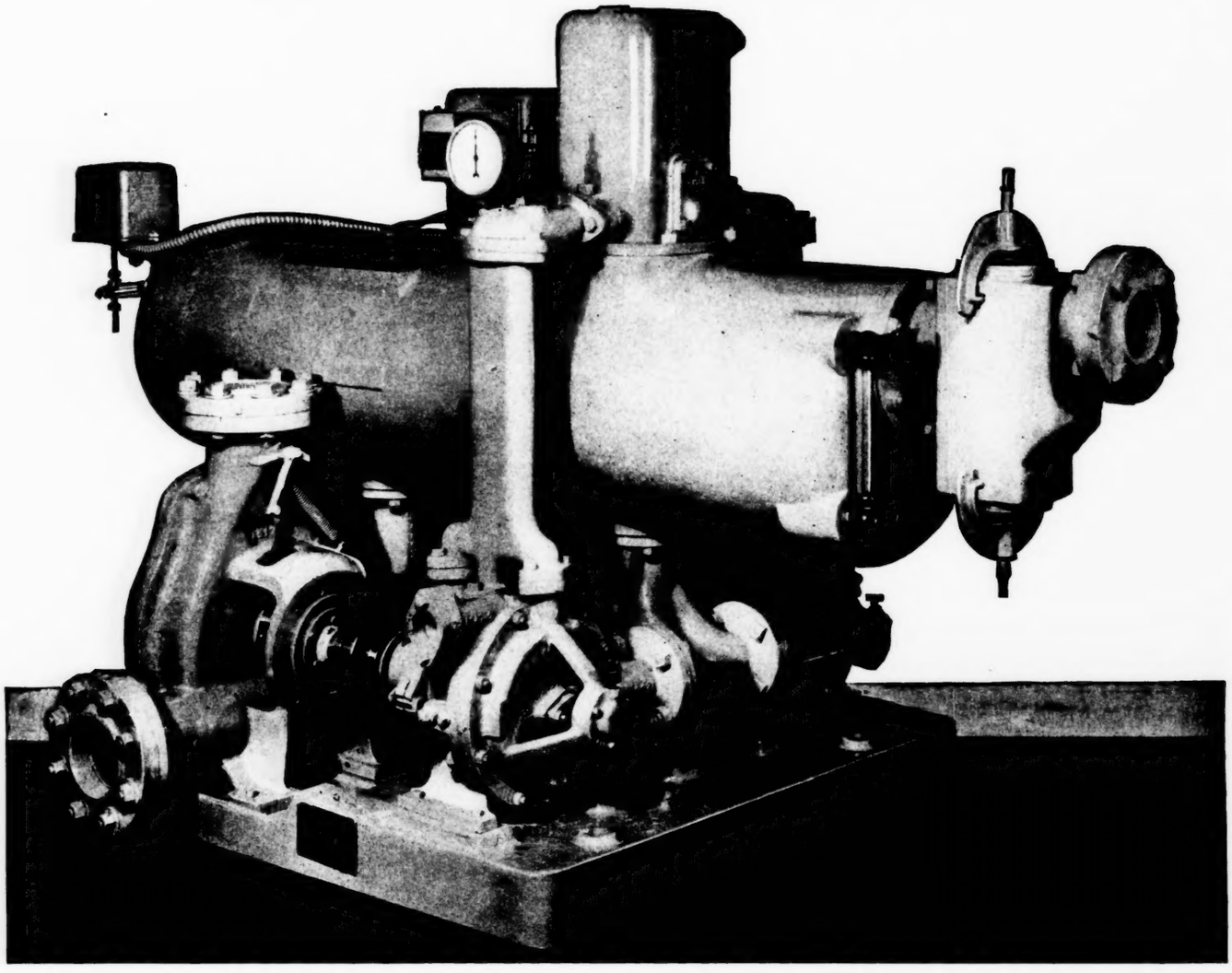
Where building heat *MUST NOT FAIL* always specify the Nash Vapor Turbine



THIS SAFE NASH HEATING PUMP DOES NOT REQUIRE ELECTRIC CURRENT BECAUSE IT OPERATES ON THE SAME STEAM THAT HEATS THE SYSTEM

In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is entirely independent of electric current failure, and continues to operate as long as there is steam in the system.

More than that, the Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump.

Greater savings still are effected by the Vapor Turbine in the system, for the reason that this pump operates continuously. It is the only pump that can do this with economy. Continuous operation means uniform circulation, and uniform circulation saves steam.

The Nash Vapor Turbine has but one moving part, rotating in the casing without metallic contact, and requiring no internal lubrication. Quiet, compact, and trouble-proof. Bulletin A-290 is free on request.

THE NASH ENGINEERING COMPANY

239 AS. WILSON ROAD • SOUTH NORWALK, CONNECTICUT • U. S. A.

An air conditioning duct of the Bristol-Myers plant at Hillside, N. J., where 104 ultraviolet emitting lamps are installed to give the factory as nearly pure air as is possible. These lamps irradiate 40,000 cu ft of air per minute. The air duct shown here is suspended from the ceiling of a regular production floor.

ULTRAVIOLET IN AIR CONDITIONING SYSTEMS

shown to be an effective weapon against harmful bacteria. Theoretical principles as well as method for computing lamp requirements explained by T. R. Porter of Westinghouse Electric and Mfg. Co.

THE use of bactericidal radiation in air conditioning ducts is gaining widespread interest. Everyone is conscious of the spread of upper respiratory diseases, especially during the winter months when, because of climatic conditions, occupied areas are, of necessity, closed to the influx of fresh outside air except that which is introduced into the air conditioning system. When low outside temperatures prevail, the amount of fresh air introduced into an air conditioning system is limited, which means that more recirculated air is used. The air that is recirculated does not demand the conditioning from a heat and humidity standpoint that would be necessary with outside air at low temperature. However, it is generally conceded that as far as bacterial population of the air is concerned, outside air is preferable to any recirculated air unless something is done to the recirculated air to relieve it of the bacteria and viruses which usually are present.

Bactericidal Effect of Ultraviolet Radiation

There is plenty of evidence in the literature to support the contention that certain wavelengths of radiation in the ultraviolet portion of the spectrum are lethal to bacteria and other micro-organisms. While different experimenters have found some variations in the effect of radiation on various types of organisms, there is general agreement that the shorter wavelengths of the sun's radiation, and the still shorter wavelengths in the ultraviolet region. can and do kill bacteria and other micro-organisms. It is also generally acknowledged that the lethal effect of the radiation increases with the shorter wavelengths. Several investigators have proved that the maximum killing effect is in the region of wavelengths of 260 mu or 2600 angstrom units.

Many independent physicists have studied the bactericidal effects of ultraviolet radiations and literally hundreds of references might be cited. However, it is felt that the references given will be sufficient to establish the essential fact that ultraviolet radiations are effective in killing bacteria.*

*Physiological Effects of Radiant Energy, Henry Laurens, Ph.D. Ultraviolet as a Bactericide, A. Bachem, Ph.D., Archives of Physical Therapy, Dec. 1935. Study of the Bactericidal Action of Ultraviolet Light, F. L. Gates, Journal of General Physiology, 13:231-248, 1929.

Interior view of radiation chamber in an air duct in the air conditioning system at the Westinghouse Lamp Division's auditorium at Bloomfield, N. J. The radiation chamber contains a battery of 40 Sterilamps, producers of ultraviolet rays of a special wavelength known to be most deadly to bacteria and mold.

Source of Ultraviolet

One of the most efficient generators of bactericidal ultraviolet radiation is the Westinghouse Sterilamp, a slender tube made of ultraviolet transmitting glass. It contains electrodes, one sealed into each end, a small quantity of mercury, and inert gases of low pressure (about 17 mm). The lamp is connected to 60-cycle, 115-volt supply circuit through a small current-limiting transformer. When the power is applied the transformer provides the necessary voltage to create a discharge through the lamp. This discharge vaporizes some of the liquid mercury. Because the mercury vapor has a smaller ionizing potential than the gases the discharge shifts to the mercury and operation continues at a reduced electrode voltage. The inert gases are used for starting the discharge and controlling the temperature operation. They contribute nothing to the emission in the bactericidal region.

The lamp is of the cold-cathode type and therefore operates at low temperatures, the tube itself being cool to the touch. Only 12 watts are consumed by a 10-inch unit. This gives only a few degrees F rise in lamp temperature. This feature of the lamp is especially important in air conditioning and cold storage boxes where heat loss is a problem. The lamp has a long life; it will burn continuously or intermittently for about 4500 hours (about six months). The useful life is ended not by failure of the discharge but by a loss of the short-wave radiation.

As is so often the case, when we learn how nature does some thing we are able to improve it. Actually the sun as a bactericidal agent is rather inefficient. It is, roughly, only one two-hundredth as effective as the Sterilamp. Whereas the noon sun at midsummer delivers enough bactericidal radiation to register one unit on the ultraviolet light meter in thirty minutes, the lamp at two feet will produce the same amount in about ten seconds. As a generator of ultraviolet it is extremely efficient; 84 per cent of the radiation occurs in the 2550 angstrom region. Less than ten per cent is in the visible spectrum, that is, above 4000 angstroms.

The lamp's output can be controlled, so that its radiation can be maintained essentially constant throughout its life. This is accomplished by increasing the current through the lamp to compensate for the reduced output.

Air Borne Contamination

Air has long been suspected of being the medium of transportation of morbid agents. The exact nature of these agents in atmospheric air remained somewhat of a mystery until Lister, utilizing the labors of Pasteur, directed surgical research into the right channels. As a direct outcome of the theory that disturbances in healing of wounds were produced by a kind of fermentation set up by living agents floating in the air, Lister endeavored to destroy these agents by the use of carbolic spray. Thus, in the early days of the Listerian period, air-borne organisms were considered one of the most important factors in wound contamination. However, despite the evidence and the results of Lister's spray, his principle and practice were accepted by only a minority of surgeons in his own country. Probably one of the reasons for this was the result of investigations into contact contamination and the importance to which was attached the results from eliminating septic contacts which far overshadowed the influence of the air in the matter of infection, that the latter was practically disregarded. The introduction of sterilization by steam (Von Vergman, 1886) and by boiling (Davidson, 1888), and the introduction of rubber gloves (Haltead, 1890), and other equally important advances quickly brought surgery into its modern aseptic era. However, despite all this, there remained small percentages of infections in all clinics which apparently could not be explained.

Exterior view of radiation chamber shown on the opposite page. Visible through the observation window are some of the 40 lamps. The ultraviolet rays emitted from these lamps kill more than 99% of all bacteria passing through the duct. The chamber dimensions are proportioned so as to give a definite exposure time as the air passes through.

Dr. Hart's work at Duke University is well known and is sufficient proof to establish that air is a vehicle of transmission of bacteria. His use of ultraviolet radiation in operating rooms is proving to be an additional chapter in modern asepsis which, no doubt, will become a part of medical history.

Investigators such as Wells, Hollaender, and others, have contributed largely to this field, and even though more proof will be necessary before it is generally conceded that air-borne bacteria are responsible for most of the common diseases to which human beings are susceptible, nevertheless it is granted that air is a mode of transfer of such organisms.

The problems in perishable food preservation can be attributed largely to the spread of food-spoilage organisms conveyed by the air. Dairies, wineries, breweries, and allied industries, are all subject to the problem of spoilage caused by bacteria and other micro-organisms which can be and are transmitted by the air. Vaccine preparation, cosmetic preparation, and all such processes are carried out under the most aseptic conditions, yet face a considerable loss from contamination from the air. These and many other industries are continually facing the problems caused by air-borne contamination.

There are two fields in which bactericidal radiation can be applied profitably in connection with air conditioning equipment. One is where air-borne contamination creates a problem in food or industrial processes, and the second where the primary reason for air conditioning is for the physical comfort of human beings, in such places as offices, theatres, auditoriums, etc. The former needs no proof when the fields in which ultraviolet lamps have already been successfully applied are considered. The second field is somewhat more intangible, yet when it is considered that bacteria which cause disease can be and are transmitted in the air we breathe, no stretch of the imagination is necessary to believe that if the number of bacteria per cubic foot of air is reduced, the probability of contracting disease from this source must, therefore, be reduced.

Ultraviolet Radiation in Air Conditioning Ducts

Knowing the amount of the ultraviolet energy required to kill the different micro-organisms and knowing also that this effect is a function of the time multiplied by the intensity to which the bacterium is exposed to the ultraviolet radiation, it becomes a simple matter to interpret the amount of energy required in an air conditioning system. The velocity of the air through the duct controls the exposure time past any one section of the duct where the ultraviolet lamps are installed and a simple calculation gives the number of lamps required for any per cent reduction required.

One of the most interesting installations of bactericidal radiation in an air conditioning system is in the General Scott Apartment in Washington, D. C. The central station air conditioning system is operated the whole year, for heating in winter and cooling in summer, and the entire system handles approximately 44,000 cfm of which 90% of the air is recirculated in the extreme climatic conditions both winter and summer. Sterilamps are installed midway between the filter bank and the cooling coils in the plenum chamber so that all air, whether it be recirculated or fresh air, is subjected to ultraviolet radiation. Four 30 in. lamps are operated in series from each transformer. The total energy input for the system is less than 2,300 watts (16 watts per lamp).

From bacteriological tests made at this apartment house, the air supplied through this system has less than five organisms per cubic foot as measured by the Wells Centrifuge, which corresponds to the average bacterial level of air in Central Park, New York City, as published in the *Journal of Public Health* on tests conducted on outside air measured in the same manner.

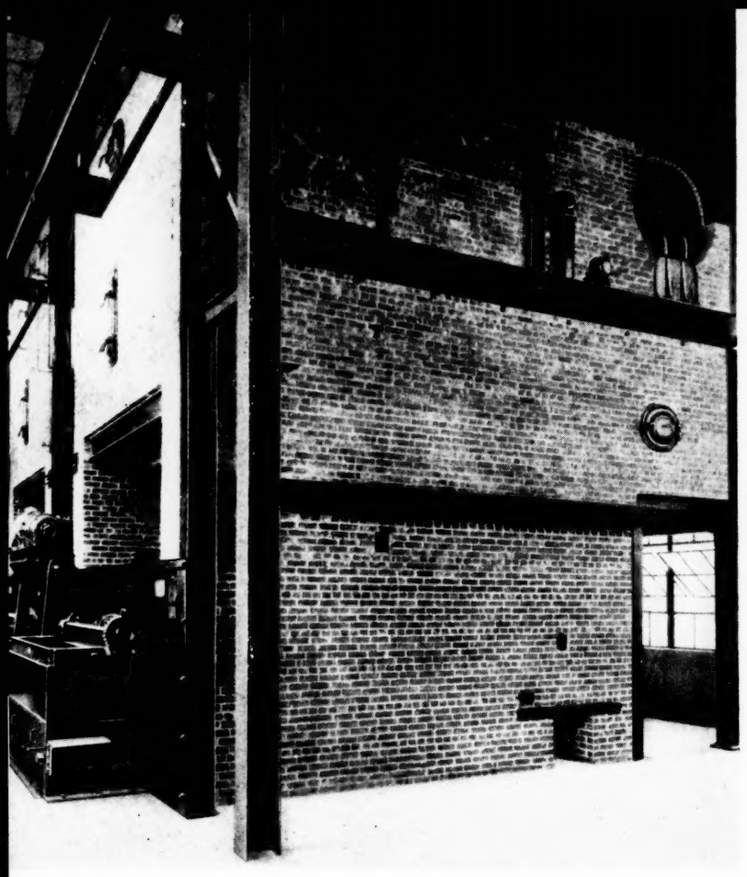


Fig. 1. Twin high pressure Stirling boilers used for heating large institution. Good maintenance keeps the boilers operating at high efficiency and availability.

Maintenance of High Pressure Boilers

By FRED D. MOSHER

IN the months to come American industrial plants will be called upon to produce more than they have ever produced before. The major part of the increased manufacturing load will be carried by existing plants, and the importance of properly maintaining the heating and process steam facilities cannot be stressed too much. The heart of any steam-supplying system is in the boiler room; and the heart functions best when it is kept in good order.

Maintenance of high pressure boilers to be effective must be consistent, planned, and systematic; its purposes are to keep equipment in such condition that service is rendered in keeping with the standards set for it, and to obtain from individual units a maximum of availability. The most ineffective maintenance programs are those of a sporadic nature; they are planless and haphazard. Maintenance may be simplified by anticipating needs and by taking steps to adjust programs so that they harmonize with seasonal load conditions.

The maintenance of heating boilers, or those whose function it is to supply heating in addition to process loads, should be started as soon as the heating season is finished. Each unit in its turn should be taken out of service for inspection, cleaning, and repairs. The job should be done systematically, and the responsibility for the completion of the job should be fixed.

Normal water level should be maintained and superheater drains kept open while high pressure boilers equipped with superheaters are being taken out of service. Before zero pressure is reached—at 10 to 15 pounds—the boiler should be vented to atmosphere. The unit should be allowed to cool completely before the water is drained, to avoid baking accumulations on the steam sides.

Preliminary Inspection

When the boiler and setting can be entered a preliminary inspection should be made to determine the kind of cleaning, and its extent, that should be done. Regardless of the kind of boiler used or the fuel burned, the cleaning should be thorough, both inside and out. Slag accumulations on furnace surfaces must be removed with care to prevent damage to the refractory. A preliminary inspection of the boiler should note carefully the formation of coke and slag, where the deposits are heaviest, and to what extent such deposits have fused with the refractory; such factors tell a story that is often worth knowing. Too heavy deposits of a tarry type in oil-burning furnaces may indicate low operating temperatures, and it will serve as a check if such a condition has actually prevailed. Spalling, and refractory penetration by slag would be an indication that furnace temperatures are either too high or that the refractory is not suitable for the service. Increased ratings and changes in the kind of fuel being burned may change furnace conditions in such a way that original refractory may have to be replaced, or modifications might have to be made to take care of the new conditions. Operators, in the course of time, may change the operating conditions in such a way that the original arrangement and type of brickwork becomes outmoded. It is always advisable in such cases to consult the builders of the equipment; experience is available and advantage should be taken of it. It must be remembered that regardless of the fuel burned the

essentials for good combustion are sufficient air supply, complete mixing of the air and fuel, temperature high enough to sustain burning, and time for the processes to take place. Examination of a furnace will often reveal whether the essentials are being adequately provided.

Soot

Soot on heating surfaces, if allowed to accumulate, will present difficulties to proper operation of a boiler. Soot is an insulator, and as such it will increase fuel consumption and consequently lower boiler efficiency. Accumulations of this sort if permitted to grow may be difficult to remove and result in high cost cleaning work. Moisture in the presence of soot may cause corrosion of air heaters, and other surfaces, and it is advisable to remove accumulations with dry air or steam if such agents are used. Power plant operators are using various methods of washing economizers and such apparatus for soot and ash removal; washing should be followed by thorough drying either by firing the boiler or by building slow drying fires for this specific purpose. The waste caused by soot deposits may be excessive, particularly if leaks occur in the vicinity of such deposits. Various types of fire tube boilers are extremely susceptible to corrosion by ash and soot.

In cleaning furnaces and boiler passes care should be taken to avoid damage to stokers, refractory, baffles, and grates. Stokers should be covered while cleaning is being done; falling pieces of heavy clinker may cause damage necessitating expensive repairs. The tuyeres of underfeed stokers often become clogged or partly clogged with fused ash and it is important that such clinker formations be removed during cleaning.

Scale

The science of feedwater treatment has reached a stage where scaling of boilers can be held to a minimum. However, boilers will get dirty, and when they do they must be cleaned. In a preliminary washing of the steam sides of a boiler as much loose material as possible should be removed. Mechanical cleaning is laborious and time consuming, and its practice should be minimized as much as possible. Various methods of chemical cleaning are now being used in a number of industrial plants and the chemical cleaning of steam generators is considered a highly successful means of removing internal deposits. For those who have not used chemicals for boiler cleaning it is recommended that the job be done on the advice or under the direction of a trained technician familiar with such cleaning procedure. Essentially chemical cleaning is done by using acid as a dissolving agent for scale; the kind of acid used may differ with the kind of scale to be removed.

It is an expensive practice to delay making repairs of any kind on steam generators. Once deterioration starts it never improves with time. When a boiler cleaning job has been completed a complete inspection of all accessible parts is in order. Corrective measures should be taken as soon as any condition requiring repairs is found.

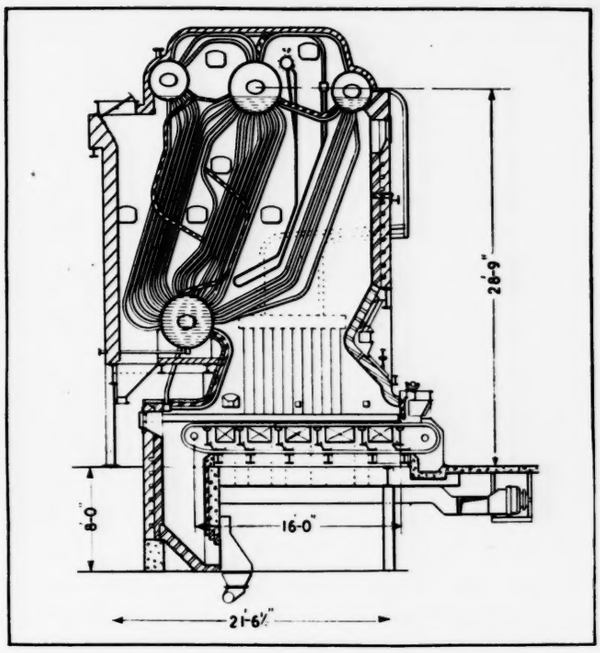


Fig. 2. Baffling in an industrial type Stirling boiler. For good performance baffles must be kept tight.

Boiler settings are a source of considerable waste if they are not kept tight. In inspecting a setting for leaks all possibilities should be checked. Setting leaks are easily traced with an improvised torch.

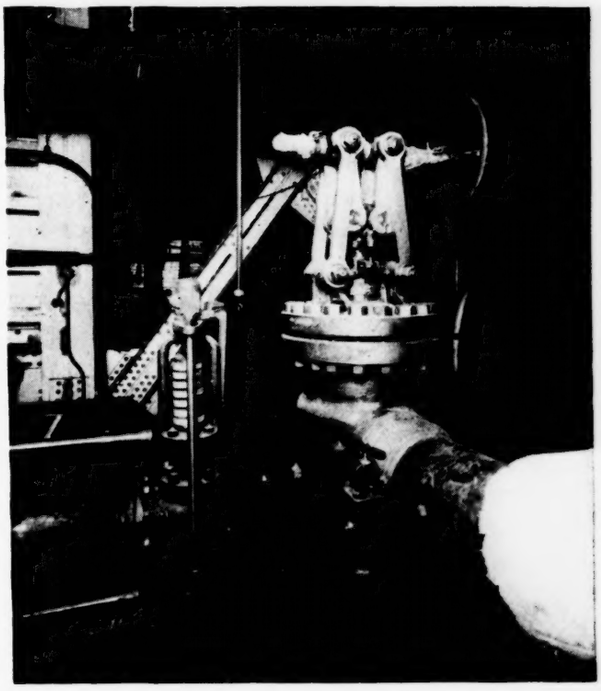


Fig. 3. Welding is universally used on high pressure piping. Example of welding of boiler stop and check valve on 650 lb. 850F boiler.

For large setting leaks caused by cracks in brickwork a good repair job can be made with asbestos rope soaked in fire clay or furnace cement. Small leaks are often repaired with stope putty or refractory cement. Many engineers suggest that all uncased brick settings be coated outside with heat resisting paint in order to keep air leakage low.

Piping

The maintenance of boiler piping and valves is a story in itself, but it is a phase of boiler maintenance that is often neglected. Leaks of any kind are waste of fuel, power, and effort. Even a very minor leak will in time waste many times over the cost of its repair. Insulation should be removed from time to time from around blowdown lines, joints, and valves. Valves should be examined and repairs should be made whenever such steps are indicated. The improper use of valves, of course, runs up maintenance costs; drain valves should always be operated wide open, if possible, and gate valves are recommended for such use. Where free blowing is required gate valves ought to be used, with globe valves recommended for throttling service. Soot blowers and piping are important appurtenances of high pressure boilers and when kept in good condition they are essential aids to high efficiency; proper alignment of elements must be maintained for effective cleaning and the protection of tube walls.

Auxiliaries

Although many steam plants operate on natural draft, most high pressure installations use forced draft. Induced draft fans are subject to severe wear when used with most steam coals; abrasion of rotors and blades may vary with methods of operation and fuel used, but heavy wear is common to most installations. Poor combustion aggravates fan erosion, but under the best of conditions induced draft fan maintenance runs high. Housing wear may be taken up by the installation of liners; rivet elimination in the fabrication and the use of welding has been found a help in reducing erosion. When fans or rotors become badly worn vibration is set up which is carried to surroundings such as housing insulation and foundations, and damage to these parts may result if the vibration goes unchecked. When blading is of mild steel construction, repairs can be made by welding, but alloy blade repairs should not be attempted without the guidance of the builders. Blades worn to a point beyond repair should be replaced without delay because of the unbalance that may be caused. A well-maintained fan under good conditions should not be expected to outlive its boiler; a boiler may outlast several poorly-maintained induced draft fans.

The housings, rotors, and blades of fans should not be overlooked in the cleaning program. As dirt and grit get heavier on fan blades more power is required for operation. Deposits on rotors and blades may create an unbalanced condition that grows worse with time.

Thorough boiler inspection at regular intervals cannot be overemphasized, and the assistance of state and insurance inspectors is advisable when repairs to pressure parts are considered necessary; this is particularly desirable when welded repairs are deemed practical. Welding is universally accepted, but specific procedures are subject to state, insurance, or municipal approval. It is common practice to repair fire checks, corroded areas, and some types of leaks by welding, but certain rules govern the extent of such repairs, and the rules may vary with location and the kind of boiler involved. In making repairs to pressure parts safety cannot be sacrificed for expediency.

Idle Boilers

There is some disagreement as to how an idle boiler should be cared for during an extended outage; there is no disagreement over the fact that a boiler should be laid up in such a way that it is preserved in good condition and protected from the deterioration that may come with disuse. In laying up a boiler, first of all, it should be completely cleaned as in regular maintenance practice; the cleaning job should be most thorough to remove all deposits both inside and out. All general repairs of leaks, brickwork, baffles, and insulation should be made before the boiler is stored, and it is important with regard to leaks that valves be tight in every case so that moisture cannot get in the unit. Possibility of water dropping on the boiler from roof leaks and overhead piping ought to be eliminated. Stoker parts and dampers should be lubricated and covered; boiler outlets should be closed at the end of storage preparation. When the boiler has been cleaned it should be dried out by the use of small coke or similar fires placed in the setting; warm air may be circulated by fans to carry away moisture. When the drying out procedure has been completed, it is recommended that trays of unslaked lime be placed in the setting and drums to absorb any last traces of moisture that might be present. The stored unit should be kept tightly closed while idle. Periodically an inspection should be made to check the general condition of the boiler, and if considered necessary, the drying fires ought to be relighted for a short period. Coating, greasing or covering of surfaces in any way is not necessary if the entire installation is kept dry and protected from external leaks.

Good maintenance alone is not a panacea for all steam plant problems, but when it is practiced in conjunction with good operation it will result in tangible dividends. Related to maintenance of steam generating equipment are the factors influenced by it, factors with which operators are deeply concerned: (a) lower fuel consumption, (b) improved performance, and (c) ability of existing equipment to meet increased demands.

What the Ventilating Engineer Should Know About Cadmium

Previous articles summarized the essential available information on carbon monoxide, benzene, hydrogen sulfide, and carbon disulfide from the standpoint of industrial hazards.† The present article is, as were the others, abstracted from the Public Health Reports of the Division of Industrial Hygiene, National Institute of Health, U. S. Public Health Service.

THERE has been a pronounced increase in the use of cadmium in industry following its introduction into electroplating materials and alloys. It is of interest that parallel with this increase in the industrial use of cadmium there has been an increased amount of cadmium poisoning. Cadmium occurs in small quantities in zinc ores (1 to 3%) and as the mineral greenockite (cadmium sulfide). It is used little as a metal directly. Its greatest importance is as a constituent of alloys and in the form of its compounds. These are used in electrical conductors, jewelry, plating, pigment, ceramics, cadmium vapor lamps, process engraving, photography, and alkaline storage batteries.

Cadmium is used as a substitute for tin in antifriction metals and in solders, its principal use being in bearing metals for automobiles. Its presence in small amounts in copper wire adds strength with but small reduction in the conductivity. Cadmium plating is used to rustproof wires, tools, and other iron and steel articles.

While there has been an over-all increase in the use of cadmium for plating, there has recently been a tendency in industry to restrict its use somewhat. This is due not only to the high cost of cadmium, but also to a questioning of its efficacy as a protective coating.

Properties

Cadmium is ductile, malleable, and capable of taking a high polish. These properties and the fact that it is resistant to corrosion and rust have caused this unusual increase in its use, particularly in the manufacture of marine hardware and in the automobile industry.

Cadmium has an atomic weight of 112.41 and a density of 8.6 gm per cc at 20C. It is a silvery-white metal with a slight bluish tinge. It is not as hard as zinc, and at ordinary temperatures is much more ductile and malleable. Like zinc, however, it becomes very brittle at higher temperatures, the change likewise appearing to be due to a crystalline transition. The electrical conductivity of cadmium is somewhat less than that of zinc. It melts at 320.9C and boils at 767C. The solubility of $Cd(OH)_2$ in water is 2.6×10^{-4} gm per liter. When heated in air, cadmium volatilizes and burns with a bright flame emitting an abundance of brown oxide (CdO) fume.

Determination of Cadmium

The analytical separation and means of identification of cadmium of greatest interest in industrial hygiene relate to the evaluation of the cadmium content of dust, or fumes, or to its presence in animal tissues or fluids. One is usually concerned with traces of the metal only, and the problem of separation and determination of these small amounts differs from that usually employed for the analytical evaluation of cadmium in ores, alloys, etc.

With reference to cadmium in animal tissues and biological fluids Fairhall and Prodan developed a colorimetric method for the determination of minute amounts of cadmium in which advantage is taken of the intensification of color of the sulfide under ultraviolet rays. A sensitivity of 1:2,500,000 is obtained by this method and an accuracy of 4% in the analysis of material containing from 0.40 to 1.00 mg of cadmium in 100 gm of organic material. This method may be conveniently adapted to the analysis of cadmium dust and fume in air samples.

A number of organic reagents develop colors with cadmium and are useful also for the colorimetric determination, provided interfering metals are removed. Among these are diphenylcarbazide, diphenylthiocarbazone (dithizone), hydroxyquinoline, p-nitrobenzene-diazoaminoazabenzene (cadion), and quinaldinic acid.

For the estimation of the cadmium content of air containing cadmium dust, samples may be obtained by drawing measured volumes through an impinger apparatus, and for the collection of fume an electrostatic precipitator may be used. The details of ashing, separation, and quantitative estimation of cadmium are given in the various references cited above.

Industrial Exposure

Industrial poisonings usually occur from the absorption of vapor, fumes, or dust, through the respiratory system. According to Public Health Bulletin No. 259, the estimated number of workers in the United States potentially exposed to cadmium is 30,927.

While the expected number of workers exposed to cadmium poisoning in the United States amounts to 30,927, the known exposure to cadmium poisoning in 15 States listed according to industry is shown in Table 1.

Among the industrial processes in which cadmium poisoning may occur are the smelting of cadmium ores, working up of residues, welding of alloys,

†See HEATING AND VENTILATING, July and September, 1941.

TABLE 1.—INDUSTRIAL EXPOSURE TO CADMIUM

Industry	Number of Workers Exposed	Industry	Number of Workers Exposed
Chemical and allied..	191	Paper and printing	19
Clay, glass, and stone	47	Miscellaneous and manufacturing industries.....	364
Iron and steel	381		
Metal industries, except iron and steel.	2,024		
Lumber and furniture.	5	Total	3,031

spraying of cadmium bearing paints and pigments, manufacture of cadmium compounds, melting the metal, and cadmium processes particularly of marine hardware and other fittings which were formerly zinc coated.

The following occupations have been listed as offering exposure to cadmium: cadmium-alloy makers, cadmium and cadmium compound makers, cadmium platers, cadmium-vapor-lamp makers, calico printers, chargers (zinc smelting), color makers, electroplaters, glass colorers, lithopone makers, solderers, solder makers, storage-battery makers, welders and zinc smelters and refiners, chemical process men, glassblowers, cupola tenders, painters, polishers, grinders, and buffers.

In the reduction of cadmium ore there is a potential exposure to arsine. The fire hazard in connection with the blue powder formed in reduction of cadmium ore and that of cadmium sulfide should also be noted. Cyanogen may be given off from the open tanks in plating.

Industrial Cadmium Poisoning

As early as 1656, Stockhusen described what is perhaps the first data on industrial cadmium poisoning in his book on lead colic and arsenic fumes. According to Stockhusen, cadmium fumes cause gastrointestinal disturbances in foundry workers, these disturbances being accompanied by diarrhea and vomiting, in contrast to lead fumes which cause constipation. Later Tracinski and Seiffert called attention to the dangers which menace workers from cadmium fumes developing in zinc workers engaged in ore distillation processes. These symptoms were similar to zinc ague and consisted of digestive and metabolic disturbances. In spite of the comparatively few known cases of industrial poisoning due to cadmium, this metal has long been considered dangerous from an industrial hygiene standpoint.

The great increase in the use of cadmium not only for coating marine hardware but also for many fittings that were formerly zinc coated has presented a new problem in industrial hygiene. Heretofore, exposure to cadmium had been very slight and was confined to the relatively small amount of metal reduced annually and to the small amount of cadmium yellow manufactured.

The first symptoms of industrial cadmium poisoning are usually dryness of the throat, cough, headache, vomiting, and a sense of constriction of the chest. Later symptoms are predominantly referable to the respiratory system and are characterized by cough, pain in the chest, severe dyspnea, and prostration. These symptoms result from a pneumonitis which in many instances is followed by bronchopneumonia. A few cases have complaints referable to the gastrointestinal tract.

There is a similarity in the symptomatology of cadmium poisoning from its fumes and dust and poisoning with other industrial fumes such as nitrous fumes and methyl bromide. All these cause severe lung damage which usually manifests itself hours after exposure, and these substances can be breathed in fatal concentrations without enough discomfort to drive the worker away from the exposure.

Poisoning by Ingestion

Cadmium may occur in food products that have been produced or processed in cadmium-plated vessels or molds. It is considered poisonous in small amounts.

Cadmium is also of importance from the public health standpoint because of its solubility in acids. The metallic cadmium coating on utensils used for food dissolves when in contact with solutions containing as little as 0.5 to 2.5% of acetic acid. Cadmium is also soluble in other organic acids commonly found in foods, such as citric, tartaric, malic, and lactic acids, even though the concentrations of these may be small. With all these, organic cadmium salts are formed. It has been stated that these salts, when taken internally, combine with the hydrochloric acid of the gastric juice to produce poisonous cadmium chloride.

Maximum Permissible Concentration

No extensive study of the permissible concentration of cadmium has been made with respect to exposure of human beings. As far as animal experimentation is concerned, the concentration necessary to produce direct toxic action has usually been far in excess of what would be permitted in industry except in case of an accident. However, in view of the fatalities which have arisen from a number of cases of exposure in industry, the maximum allowable concentration of cadmium or of its compounds in air has been accepted as 1 milligram of cadmium per 10 cubic meters of air.

Prevention of Industrial Cadmium Poisoning

Prevention of industrial cadmium exposure depends upon the type of process involved in which cadmium fumes are generated. Where cadmium plating is done, prevention may be obtained by the use of specially-designed exhaust ventilation systems, which are similar to those used in clearing the air of chromium vapors in the process of chrome plating. For some processes, a positive pressure mask is necessary for protection of exposed workmen. An approved type of respirator is recommended where the concentration of cadmium is low; a soda lime cartridge may be attached to the respirator when acid fume is also present in the atmosphere. The positive pressure mask should be used in all cases where the cadmium content is high.

Fig. 1. High School Building, one of the three buildings served by the central heating plant of the Burlington Independent School District.

School Plant Reduces Steam Costs from 54 to 20 Cents per 1000 Lb.

By EARL WIEGAND†

THE Burlington, Iowa, Independent School District recently improved the central heating system it operates for three buildings, including the high school, as a result of which the cost of steam for heating has been reduced from 54 cents to 20 cents per 1000 lb. For the year previous to modernization the fuel bill was approximately $5500, while for the year after new equipment was in service this figure had been reduced to $2680, the load having been substantially increased concurrently with the installation of the new equipment.

The old steam plant consisted of three Murray type-A stoker fired boilers which had been in service nearly 40 years, and it is not difficult to understand that they needed replacement in the interest of efficient operation. The new plant, installed in the summer of 1940, consists of one 208 hp Murray cross-drum water-tube boiler designed to operate at 250 lb pressure. At present the operating pressure is 115 lb but as the electric load increases it will be possible to add a superheater and increase pressures to 250 lb so as to drive a turbine-generator unit. The boiler is fired by two Iron Fireman spreader type bin-feed stokers. Hays automatic combustion control provides for efficient operation and the maintenance of constant steam pressure under all service conditions. Experience has shown that pressure variations are no more than 1 lb, plus or minus.

With this summary of the installation in mind it will be of interest to consider some of the details. The boiler has been set 3 ft higher than the standard setting and 12½ ft from the grate line to the first bank of tubes. The tubes have a rather steep pitch of 3 in. to the linear foot, which greatly facilitates circulation. The furnace has a solid firebrick wall throughout. The boiler also has 4 in. of insulating material and is covered by a complete envelope casing of metal. It has an effective heating surface of 2000 sq ft.

Coal is conveyed from the old bin by two worms at floor level and is forced by air pressure through the pipes to the burners under the boiler. This arrangement with the pneumatic elements of the stoker in a separate out-of-the-way location is one of the advantages of this type of stoker as it makes for cleanliness in the boiler room as well as the elimination of a great deal of labor.

Both stoker and boiler are designed for operation at a minimum rating of 60%, a continuous rating of 200% and a maximum, for two hours, of 250%. Central Illinois coal from ⅛ to 2 in. in size is used, and the average operating efficiency for the heating season of 1940-41 was 71.8%, the average CO_2 12%. Up to Dec. 30, 1941, well into the second year of operation, there had been no expense for stoker maintenance. There is no smoke nuisance.

With stoker-firing it is not necessary to have more than one man at any time in the boiler room, whereas two were previously called for much of the time. This

†Chief Engineer, Burlington Independent School District.

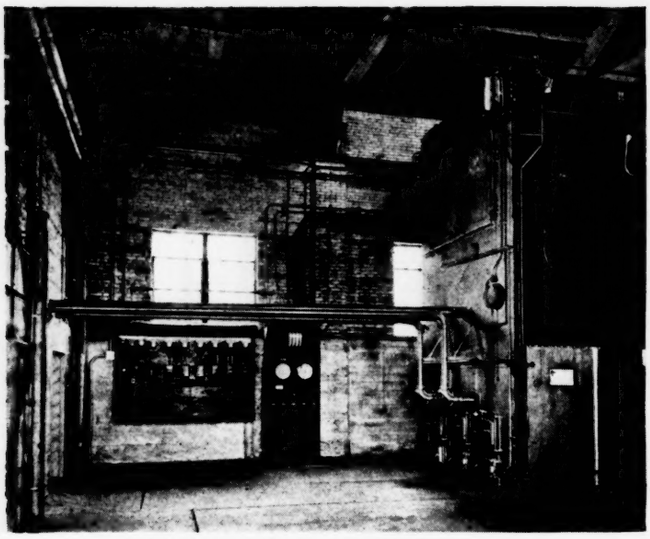


Fig. 2. Front of new boiler showing pneumatic stoker burners entering furnace.

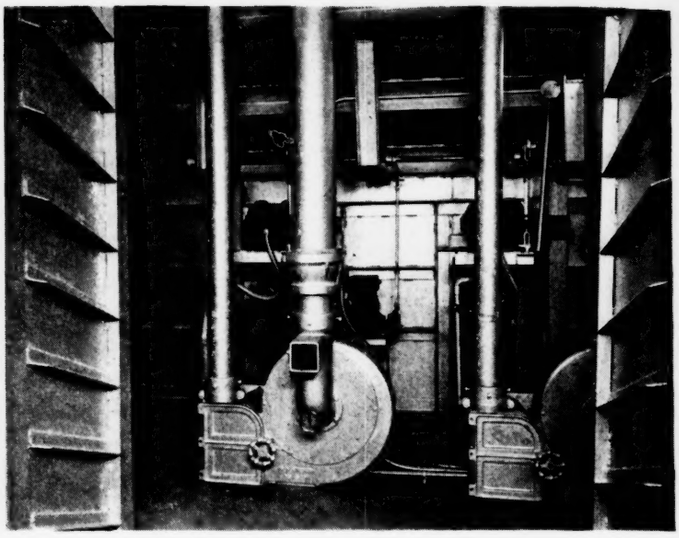


Fig. 3. Pneumatic portion of the stokers, located in a room separate but adjacent to boiler room.

labor saving amounts to $600 annually. This is due to the elimination of coal shoveling, reduction of ash and clinker to be removed, and ease of keeping the plant clean. With the old equipment it was also necessary to replace three large and expensive arches each year at a cost of more than $500.

At the present time there is a total of somewhat more than 82,000 sq ft of radiation in the three buildings, located at some distance from the central heating plant. The Industrial Arts Building is entirely equipped with direct wall-hung type radiators. The newer and larger part of the High School Building is provided with unit ventilators augmented by direct radiators in each room. The older part of this building has a central fan system with large tempering chambers located in the basement and using forced circulation. The Field House is equipped with unit heaters and is at a considerably lower level than the heating plant. For this reason it has been necessary to install a steam-driven condensate return pump.

Steam is distributed from the central heating plant to the High School Building through a tunnel 4 by 6 ft, 658 ft long. This line is 8 in., high pressure, of wrought iron, and all welded.

Improving Production with Steam Accumulators

Steam storage systems installed in many plants have made surprising savings in fuel and maintenance, as well as improvements in production. The principle on which such a system operates is that heat from steam produced in the boilers during periods of low steam demand is stored in an accumulator for release during periods of peak demand. The boilers will then operate at a more even rate and will be relieved of the rapid changes in rate following sudden increases in load.

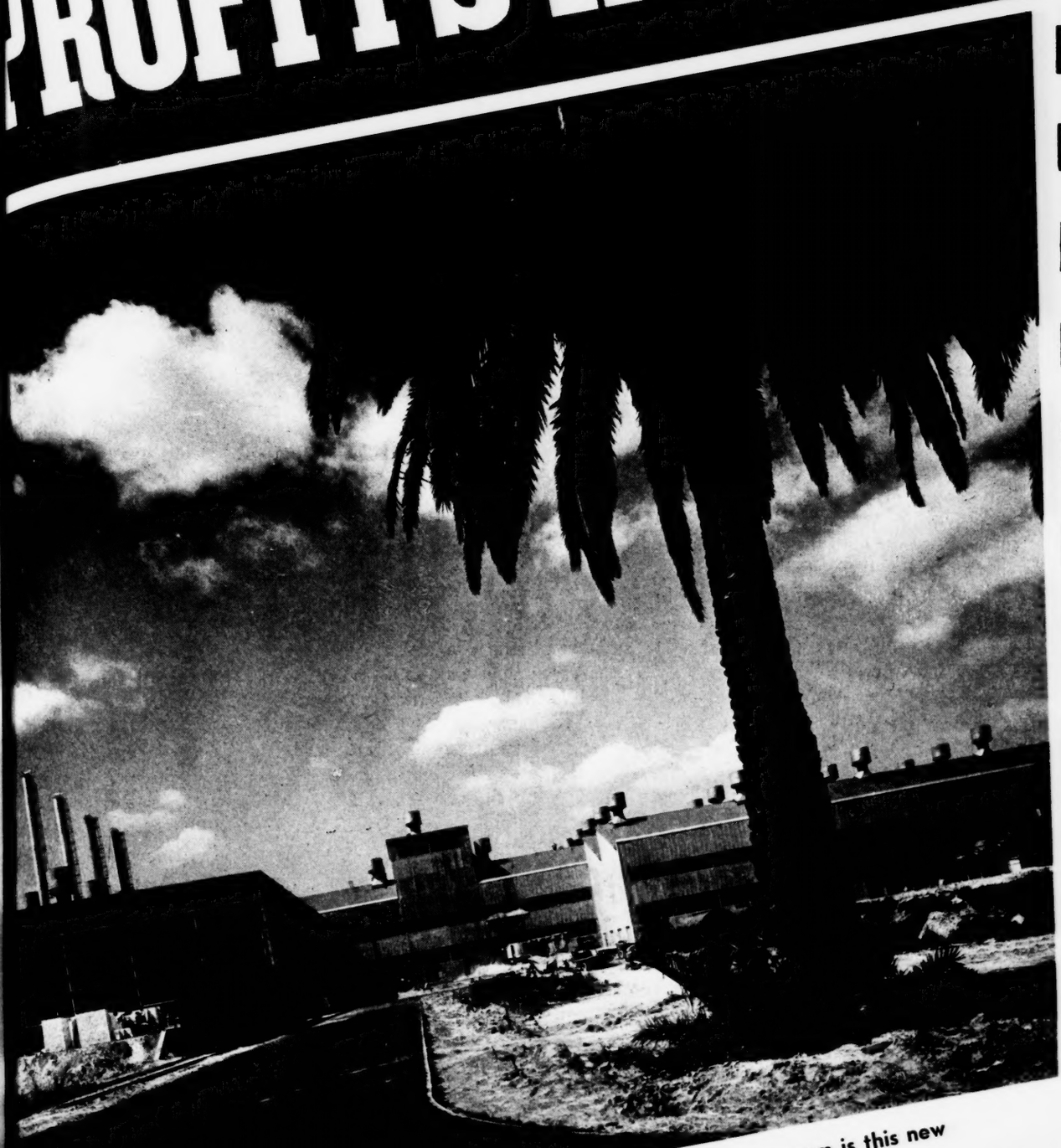
The most common application of steam accumulators is in plants using process steam at a pressure lower than that at which it is produced in the boiler. Such an accumulator consists of a large, closed vessel connected by pressure-reducing and flow-control valves to both the boiler steam line and the low pressure processing system. During periods of reduced demand, steam from the boilers flows into the accumulator, condenses, and heats water contained therein. Heat can be stored in this manner until pressure in the accumulator equals boiler pressure and the water is at saturation temperature corresponding to that pressure.

When a peak demand occurs, enough steam is automatically released from the accumulator to the low pressure system to hold a steady pressure. Pressure within the accumulator will fall as steam is released, causing more water to be evaporated into steam by the heat stored in the water. Pressure within the accumulator will therefore vary according to steam demands while the high and low pressure steam systems are held at virtually constant pressure.

In plants where fluctuations are caused by equipment operated at boiler pressure, feedwater accumulators have been installed to effect a like improvement in operation. In this arrangement, the storage system takes the form of a large closed feedwater accumulator having a direct contact heater in which steam at boiler pressure is used to heat the feedwater to saturation temperature. Feedwater is pumped directly from the accumulator to the boilers.

The operation of this storage system is controlled by a regulating valve on the feedwater line permitting steam and water to enter the heater of the storage system only during periods of low demand. At peak demands the flow of both steam and water into the storage system is stopped but feedwater continues to be withdrawn from the accumulator and fed to the boilers. In this way the boilers may operate at a constant rate using the excess steam during fluctuations to heat feedwater, and reducing the work to be done later in the boilers.—*Heat Engineering*

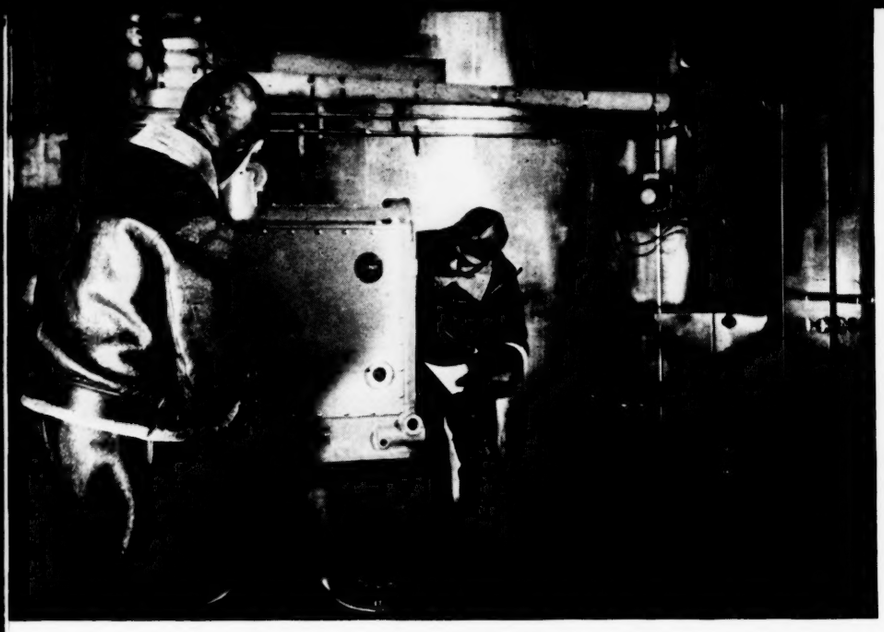
PROFITS IN AIR



Planned as part of Aluminum Company of America's huge expansion program is this new extrusion mill at the Vernon, Los Angeles, works of this company.

...W INDUSTRIAL PLANTS PROMOTE PROCESSES BY CONTROL OF AIR CONDITIONS

- METALLURGICAL
- FOODSTUFFS
- ORDNANCE
- CHEMICALS
- AIRPLANES
- FOUNDRIES
- TOBACCO
- TEXTILE
- BAKERIES
- ELECTRICAL
- FILMS
- INSTRUMENTS
- GLASS
- MACHINE SHOPS
- PHARMACEUTICAL
- PLASTICS
- PAPER
- RUBBER
- PRINTING



All-Weather Laboratory for Testing Bomber Instruments

Fig. 1. Test of anti-aircraft director to determine the best types of lubricants to use under Arctic conditions.

RAIN, snow, fresh or salt water fog, any degree of humidity, intense sunlight, and temperatures ranging from —50 to +150F, are some of the weather effects which can be produced at will in a special testing room recently built by the Sperry Gyroscope Company.

Many of the company's products such as directional gyros, gyro-horizons, high intensity searchlights, and others, especially those installed on the Army and Navy bombers, must function properly in all climates and temperatures. Under war conditions it is not possible to make tests in all parts of the world to develop this equipment and, under any circumstances, the work can be done more quickly and satisfactorily in a laboratory where the atmosphere is under control.

The room is 10 ft high by 11 ft square. It is made of an inner shell of welded stainless steel with insulating material surrounding it. On account of the great changes in temperature the expansion and contraction of the steel is a serious problem, and it has been met by suspending the shell from its top center.

Low temperatures are produced by use of a 5-ton Freon unit, with supplementary cooling provided by a dry ice booster unit. The compressor is driven through a Reeves variable speed motor pulley in order to provide for the required temperature ranges. This unit shown in Fig. 2 is located just outside the weather room with the controls adjacent. In addition there is a circulating fan, above the refrigerating unit but not shown in the picture, which is also motor-driven through another variable speed pulley, so that with the help of the two speed-controlled units the necessary flexibility for quick changes is adequately provided for.

The stainless steel construction makes the room corrosion-proof from the moisture which is bound to condense on the walls, and it is impervious to the ultra-violet rays used to simulate intense tropical sunlight. The men working in this laboratory wear bathing suits or heavy flying suits, depending on the kind of weather they are using. Communication with the outside is by means of a two-way speaking device or signalling through a window having six layers of glass.

Much valuable information has already been secured from tests conducted in this laboratory. For instance, some greases harden to the consistency of paving asphalt at low temperatures, and some synthetic rubbers become comparable to bakelite, while certain types of plastics turn brown and break under exposure to ultra-violet light and high temperatures. —*Francis A. Westbrook.*

Fig. 2. View of weather-making equipment located just outside of test room.

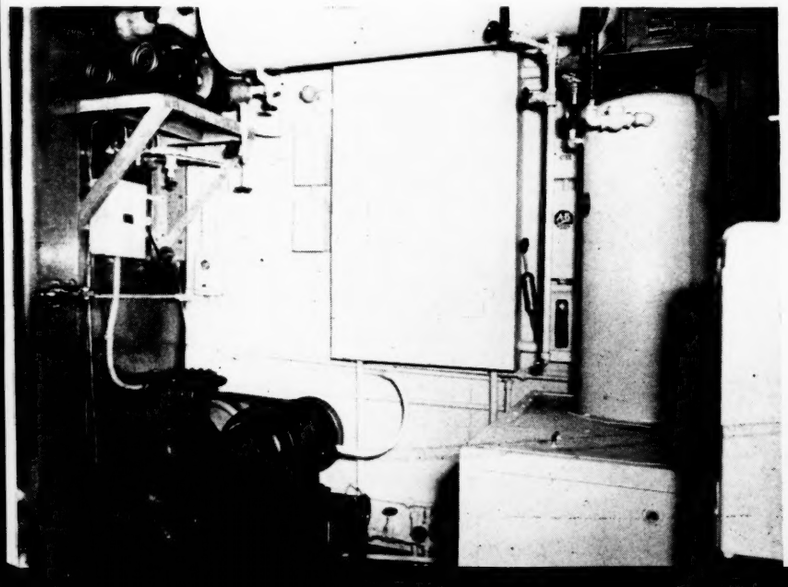


Fig. 3. Shows preliminary tests being made on lubricants at —35F.

TORPEDO BOATS

for the U.S. Navy are designed in air conditioned drafting rooms and offices, where 80F and 60% are maintained to offset 100F summer temperatures.

By ROBERT LATIMER

PRODUCTION of P-T torpedo boats — those swift, mosquito-like motorboats which can dash in, sink a battleship and be gone only a few miles per hour behind record-holding speedboats—is being considerably facilitated at the southern plant of Higgins Industries, since the air conditioning division of the same firm installed a 60-ton air conditioning system to cool the administrative, drafting, training and personnel offices of the huge plant.

The plant is the first step in a huge expansion program under which Andrew Jackson Higgins, veteran shipbuilding contractor, will produce not only torpedo boats but 200 Liberty ships for transoceanic war shipping. The plant was completed in October of last year. Air conditioning has played a large part in turning out perfectly-designed torpedo boats since the first unit started down the 300-foot assembly line in the factory.

A three-story building, operated by Higgins Industries, the plant encloses a former factory building. On the top floor is the huge drafting department which lays out plans for each boat; on the second floor are the general offices and management departments, purchasing and naval offices; and on the first floor, a publicity department, personnel office, and a group of classrooms for Navy training of boat pilots, navigators and crews. In each of these departments, air conditioning was absolutely essential because of the 100F summer temperatures and 90% humidity conditions common to the locality. Without it, loss of man hours through illness and mistakes in drafting, etc., would seriously hamper the rapid production of the torpedo boats. Particularly in the drafting room, on the top floor and exposed to a heavy sunload magnified by a metal roof, was it necessary to provide cool comfortable conditions for draftsmen working on blueprints and specifications.

The air conditioning system installed to insure health and pleasant working conditions was designed by Weil & Moses, consulting engineers, and installed by the Carrier division of Higgins Industries, headed by George Macheca. Cooling only the administrative, training, drafting and personnel offices, the 60-ton system can operate at maximum economy through a four-step compressor arrangement.

To save space, the refrigerator equipment was installed on the roof of a second-story building which was enclosed under the main roof when the plant was expanded to its present size. Located here are two compressors, and two evaporative condensers, compactly built up in combination with duct-type gas fired unit heaters for the short winter heating period. A direct-expansion installation, the distribution includes one fan station per floor, each containing a single bank of coils, a blower, and thermostatic controls in the return ducts. Dampered intakes on each blower housing connect with fresh-air in-

takes, permitting admission of fresh outside air up to 65% and the use of the system for ventilation only if desired. Also suspended in the ductwork are gas unit heaters, flanged in at the front and back and insulated tightly, ranging from 150,000 to 225,000 Btu input, and utilizing the same blowers for year round conditioning. Unit heaters are likewise thermostatically controlled. The capacities are 7600 cfm on the first floor, 9000 on the second, and 6300 on the third floor, with provision for manually altering the capacity according to requirements. Return air through three main ducts which drop down to the first floor, level on the second and rise to the third floor, comes off the third and second floors only. The heaviest cooling load, according to the engineers, is concentrated on the second floor general offices. Distribution of cooled air throughout is by means of ceiling Venturi-Flo outlets, spaced 14 ft apart down the soundproofed ceilings on each floor. Powers regulators are set to maintain 80F with 60% relative humidity over all floors.

The convenient rooftop location of the compressor plant on the enclosed building made it possible to dispense with much ductwork. At average operation the plant will expend only around 30 tons capacity, padding another 15 tons during the hot afternoons, and the remaining 15 tons at peak load. Except for a short period each night, the system will run almost continuously, heating, cooling or ventilating the building.

Tests Reveal Performance of Grain Bin Ventilating Cowls

Grain bin ventilation has been made the subject of extensive study by C. F. Kelly, M. G. Cropsey, and W. R. Swanson, of the Bureau of Agricultural Chemistry and Engineering and the U. S. Department of Agriculture. Their test results and observations are told in detail in an article in a recent issue of *Agricultural Engineering*

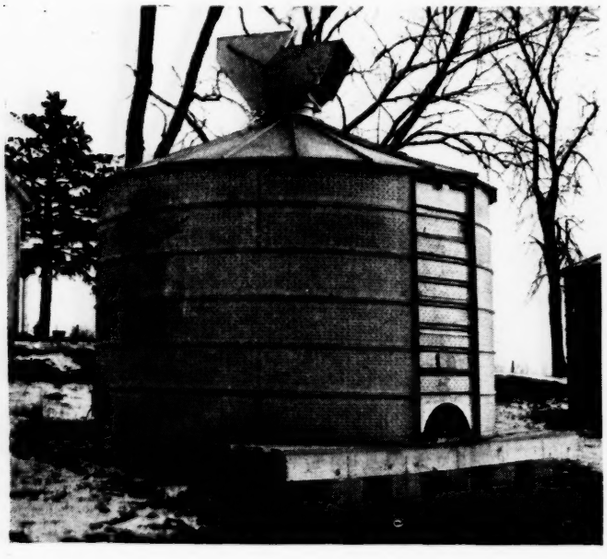
Grain bins such as those shown here, which were of the type investigated, are normally ventilated by means of fresh air hoods and ducts, the arrangement being such that outside air is circulated through the grains as a result of wind action. This ventilation is necessary in order to keep the grain dry and to carry away the heat which is slowly generated under such conditions. Since the bed of grain is usually two feet or more in thickness, it can be seen why there is considerable resistance to the flow of air and why something more than natural convection is needed.

Cowls of the pressure type (Fig. 1, below, left) and the suction type (Fig. 2, right) were tested. The tests were intended primarily to see which type had the greater flow-producing capacity, and for the secondary reason of determining ability to keep snow out.

The conclusions which the authors drew from the tests are as follows:

In tests of four different types of bin ventilators, two pressure and two suction, at Fargo, N. D., it was found that the air pressure developed by the pressure cowls closely approached the velocity pressure of the wind, but that the negative pressures developed by a turbine ventilator and a suction cowl were only about 40% as great. In other words, pressure cowls are about two and one-half times as effective as suction cowls in developing head or pressure from wind for use in creating air movement through grain.

None of the cowls or duct systems which were on test during the periods of highest winds excluded all snow, indicating that ventilators should be closed during winter months. It was observed that in storms with ordinary wind velocities louvers were of benefit in excluding snow from pressure cowls and that the suction ventilators did not catch as much snow as the open face pressure cowls.



PROFITS IN AIR

Springfield Armory

cafeteria, serving 2600 daily, heated by unit ventilators suspended above the windows.

OPERATING sixteen hours out of 24, but with work behind the scenes going on around the clock, the new Post Restaurant at the Springfield Armory, where the famous Garand rifles and other ordnance are manufactured, serves around 2600 workers who get one or more meals daily at one of the best equipped cafeterias in New England.

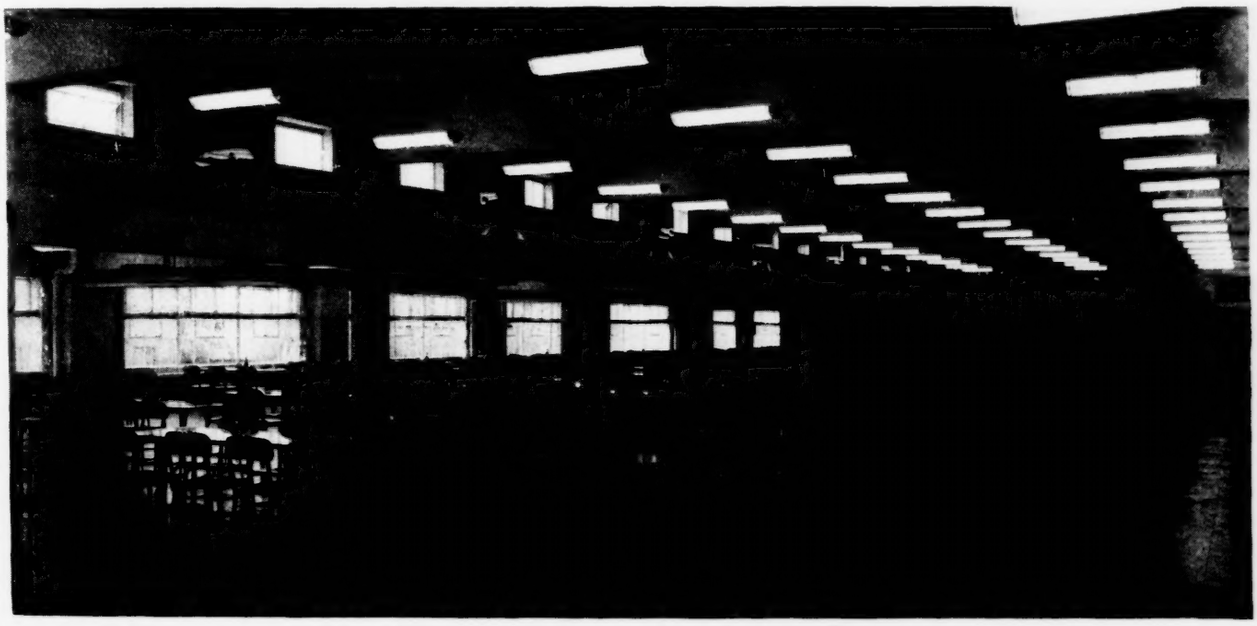
There are 10,000 workers at this enormous government plant but all do not eat at the new restaurant. Mobile canteen wagons are used for supplying hot lunches to other workers who cannot leave their machines.

The restaurant is on the top floor of a building the other floors of which are devoted to manufacturing. Heat for the entire armory layout, including the new building, is supplied from a central plant by means of underground mains.

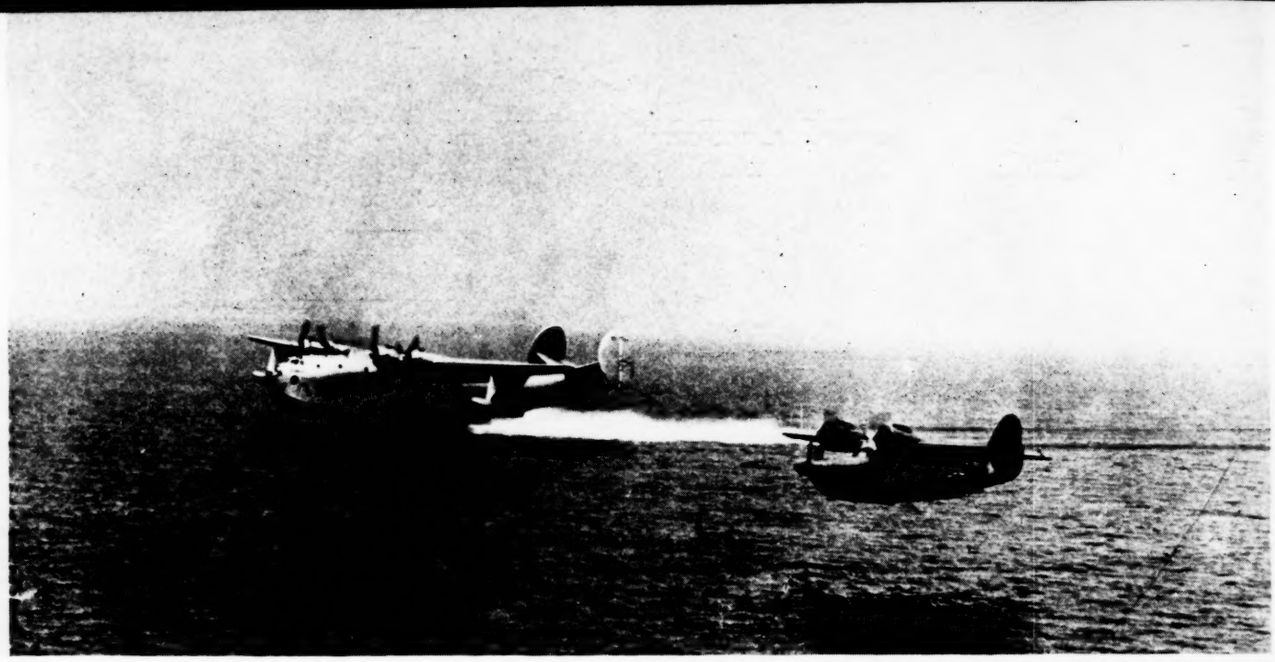
Twenty-five Herman Nelson unit ventilators, cabinet type, are suspended from the ceiling of the restaurant, each supplying 1,000 cfm of outdoor air. They are arranged so that either all outdoor air or all room air, or any mixture of the two can be introduced to satisfy the room temperature, control of which is by varying the amount of air passed to the heating element or by-passing it around the heating section so that if the room is overheated, the unheated air will lower the temperature. In summer the units may be used for air circulation without heat.

On the first floor of the same building the Herman Nelson Company has installed six 5,000 cfm units, operating on the same cycle as those in the restaurant. In many other parts of the building, used for manufacturing processes, factory type regular Herman Nelson unit heaters are installed for heating numerous rooms. All are controlled by a thermostat.

The restaurant seats 600 persons at a time, the men eating at staggered periods, but there is almost as much space available at one end for more tables. Floor area approximates 19,000 square feet, including kitchen, dish washing room, serving counter and dining room. Exhaust for this floor is by fans in a large duct leading to the roof.



View looking toward serving counter in the restaurant. One row of the double row of Herman Nelson unit ventilators can be seen along the wall at ceiling height.



The Glenn L. Martin Company's great supercharged flying boat, the 70-ton "Mars," takes off for her maiden flight, her size indicated in contrast with a Grumman amphibian beside her.

Martin's "Mars," Largest Flying Boat, Has Supercharging of Air for Crew.

THE entire flight deck and a large portion of the main deck of the Martin *Mars*, world's largest flying boat, is supercharged, permitting normal breathing without oxygen masks or tubes miles above the clouds, it has been revealed by the Glenn L. Martin Company. In addition, all of the crew enjoys at all times the benefits of modern heating, however high into the frigid atmosphere above the earth the plane may range.

Both of these features contribute to the efficiency of all hands by permitting them to work, fight, eat and sleep with the same comfort they would have on a surface vessel or on land. Glenn L. Martin, president of the Martin Company, and pioneer advocate of long-range air transport for both war and peace time, contends that physical comfort plays an important part in the efficiency of all hands aboard, especially at high altitudes. In giving $450,000 to found The Minta Martin Aeronautical Laboratory recently, Mr. Martin pointed out that the effects on pilots of high altitude flying is one of the great problems requiring intensive study.

"I hope that from the new Laboratory," he said, "will come developments which will make substratosphere flying more comfortable and safer for our combat pilots. It is also important that after the war passengers be flown at higher altitudes."

The supercharging of the great ship is confined, for practical reasons, to that portion forward of the wings. It is done with an auxiliary engine that keeps the forepart of the ship pumped chock full of air. Even though the air about the ship may be too thin to support life, it is not necessary that the men flying her sit about, movie-fashion, with oxygen tubes in their mouths. They breathe naturally as they go about their business of operating the ship, laying her course, and sending and receiving messages.

From the flight deck a spiral staircase descends to the main deck, where the crew has its quarters. These include staterooms, washrooms, two large dining rooms, and a galley to cook in. The galley's equipment includes a three-burner electric stove and an electric refrigerator with a capacity of 14 cu ft.

The engine pumping in air begins to operate at an altitude of 8000 ft, where ordinary breathing is still easy. Although it was not feasible to supercharge the whole vessel, the entire interior is heated by air drawn over blast heating coils, which warm it to comfortable temperature.

Because of differences in air pressure within the hull when the ship is at high altitude, it is necessary for a man moving from one end of the ship to the other to pass through a decompression chamber. This allows him to become accustomed gradually to the different atmosphere into which he is about to step. Oxygen stations are set up throughout the hull, which has the volume of a fifteen-room house, in case of emergency.

Another interesting feature of the *Mars* is the 28-station telephone system that covers all points of the hull. A man can sit at his meal high above the clouds and receive or give orders between mouthfuls. And during battle he can give or receive instructions without stirring from his post.

In these ways, without sacrificing a bit of her efficiency in peace or in battle, the *Mars* makes her crew of thirteen men as comfortable above the clouds as they would be on a surface vessel or on land.

IDENTIFICATION SCHEME FOR PIPING SYSTEMS

TABLE I.—CLASSIFICATION OF MATERIALS CARRIED IN PIPES

Material Piped	Physical State, Gas, Liquid, or Semi-Solid	Temp. of Material in Deg., F (Max.)	Pressure in Lb., per Sq. In. (Min.)	Classification
Acetic acid	Liquid	Normal	30	D
Alcohol	Liquid	Cool	.....	D
Amyl acetate	Liquid	Cool	.....	D
Alum solution	Liquid	.....	.....	S
Acetylene gas	Gas	0 to 200	Up to 250	D
Benzol	Liquid	Cold	Up to 80	D
Brine	Liquid	Cold	About 60	S
Butane	Liquid and Gas	Normal	¼ to 50	D
Butyl alcohol	Liquid	Cool	.....	D
Bleach liquor	Solution	.....	.....	D
Bisulphate liquors	Liquid	.....	.....	D
Blau gas	Gas	0 to 200	Up to 250	D
Compressed air	Gas	80	300 (in special cases 3000)	S
Carbon dioxide	Gas and Liquid	−30 to −100	0 to 250	D
Caustic soda solution	Solution	.....	.....	D
Chlorine	Gas, Liquid, and Solutions	.....	.....	D
Carbon bisulphide	Gas and Liquid	.....	.....	D
Chloroform	Gas and Liquid	.....	.....	D
Carbon tetrachloride	Liquid	.....	.....	S
City gas	Gas	Normal	1/6 to 20	D
Coal gas	Gas	0 to 200	Up to 250	D
Dyes	Solution	Usually cool	.....	D
Flue gas or waste heat	Gas	0 to 200	Up to 250	D
Foamite	Liquid	Cold	Up to 100	F
Freon	Liquid and Gas	Cold or normal	0 to 100	V
Gasoline	Liquid	Normal	.....	D
Glycerine	Liquid	Hot and cold	Up to 60	S
Hydrochloric acid	Liquid	Up to 80	2 to 10	D
Hydrogen	Gas	.....	.....	D
Hydrogen sulphide	Gas	0 to 150	Up to 100	D
Intermediates	Solution	Usually cool	.....	D
Kerosene	Liquid	Normal	.....	D
Lacquer thinner	Liquid	Normal	.....	D
Lactic Acid	Liquid	Normal	60	V
Lubricating oil	Liquid	.....	.....	V
Methyl Chloride	Liquid and Gas	Cold or normal	0 to 100	V
Mixed acid	Liquid	Normal	30 to 80	D
Miscellaneous solvent	Liquid	Cool	.....	D
Mercury	Gas and Liquid	.....	Up to 100	D
Muriatic acid	Liquid	.....	.....	D
Natural gas	Gas	0 to 200	Up to 250	D
Nitric acid	Liquid	Normal	10	D
Nitro bodies	Liquid	Cool	Up to 40	D
Ammonium nitrate (molten)	Liquid	.....	None	D
Ammonia	Liquid and Gas	−30 to 100	0 to 250	D
Nitrous oxide and nitrogen trioxide	Vapor	0 to 150	Up to 100	D
Oils (Petroleum)	Liquid	Below 580	Below 1200	D
Oxygen	Gas	Normal	0 to 100	V
Paper sizing solution	Liquid	.....	.....	S
Pinch gas	Gas	0 to 200	Up to 250	D
Producer gas	Gas	0 to 200	Up to 250	D
Propane	Gas	Normal	¼ to 50	D
Pyrox compounds	Liquid	Up to 80	.....	D
Paint	Liquid	Cold	30	D
Sulphuric acid	Liquid	Up to 180	30 to 80	D
Sanitary Piping	Liquid	Normal	.....	S
Soda ash solution	Liquid	Cold	60	S
Sprinkler piping	Liquid or dry	Normal	15 to 100	F

TABLE II.—KEY TO CLASSIFICATION

F—Fire Protection	Red
D—Dangerous	Yellow
S—Safe	Green
P—Protective	Blue
V—Extra Valuable	Purple

TABLE III.—SIZE OF STENCIL FOR VARIOUS PIPE SIZES

Outside Diameter of Pipe or Covering, Inches	Height of Stencil Letter, Inches
¾	½
1	½
1¼	½
1½	¾
2	¾
2½	¾
3	¾
3½	1¼
4	1¼
4½	1½
5	1½
6	1¾
7	2
8	2½
9	2½
10	3
11	3
12	3½
13 and over	3½

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IDENTIFICATION SCHEME FOR PIPING SYSTEMS

A number of standardization schemes have been proposed from time to time for the marking of industrial and power plant piping to indicate the kind of material carried in the pipes. The method here outlined conforms to the recommendations of the American Standards Association, as presented in its latest bulletin on the subject. Table I, taken from the bulletin, has been expanded by the addition of certain new materials. It is in line with the hope expressed in the bulletin that the system recommended would in time be widely adopted, and also in the belief that this scheme is the most generally applicable yet conceived, that presentation of its fundamentals is here given.

The basis on which the identification scheme rests can be stated as follows:

1. Any material transported in pipes in a plant will fall into one of five main classifications. These are listed in Table II—Key to Classifications.

2. Each of these five classifications is distinguished in the scheme by its own basic color.

3. Sub-classification of various materials in the five groups is indicated by appropriate legend along with the color.

4. Use of the various colors and legends is made in accordance with certain specifications, these dealing mainly with the location and frequency of color bands and legends, and the size and position of the legends with a view to insuring their easy visibility.

Definitions of the five main classes into which materials are divided are as follows:

(1) Dangerous materials, defined as those which in themselves are hazardous to life and property because of being inflammable, explosive, poisonous, or productive of poisonous gases.

(2) Safe materials, or those presenting no hazard to a workman opening such a pipe line; these materials also have very little value.

(3) Protective materials, or those kept available to minimize or prevent the hazards of the dangerous materials mentioned above. For example, certain special gases may be piped through a plant to act, in case of emergency, as antidotes for poisonous fumes.

(4) Extra valuable, or materials which could be classified as safe, but which are too valuable to risk having firemen or careless workmen waste by accidental breaking of lines.

(5) Fire protection, or materials which common practice has so established in their own separate classification, with red the accepted color, that this classification is retained. Otherwise, these materials could be put in the protective group.

In accordance with the foregoing, the procedure, then, for working out a piping identification scheme for any particular plant can be detailed in the following steps:

(1) List all materials carried in pipes.

(2) Assign each of these to one of the five main divisions, as shown in Table II.

(3) Choose between a method of color marking where the entire pipe line is painted the basic division color, and a method where only occasional color bands, 8 to 10 in. wide, are painted on the pipe.

(4) Make up stencils for the various kinds of materials and for various pipe sizes. Table III shows the recommended size of stencil for various pipe sizes. Pipes smaller than ½ in. in diameter should be tagged.

(5) Paint the pipes, either with color bands or with complete coatings of paint.

(6) On the bands or pipe at all key points such as valves, tees (see Fig. 1), crosses, or Y-branches; at points where pipes disappear behind permanent obstructions or into walls, floors, ceilings, or where they emerge from them; or at any points where quick observation is available and will be needed in an emergency, stencil the identifying name or abbreviation of the material. This legend ordinarily should be placed on the bottom half of the pipe, facing about 30 degrees downward toward each side. Where the view from this angle on the floor is obscured by other pipes or objects, the legends should be so placed as to give the most favorable and convenient visibility.

Since, as a matter of habit, the eye is most accustomed to reading black letters on a light background, it is recommended that black letters be stenciled on the band of main classification when that color is light, and on a rectangular background of aluminum paint superimposed on the main color band when that color is dark.

Directional arrows stenciled on adjacent to the legend may also be employed as a useful means of indicating direction of flow in the pipe.

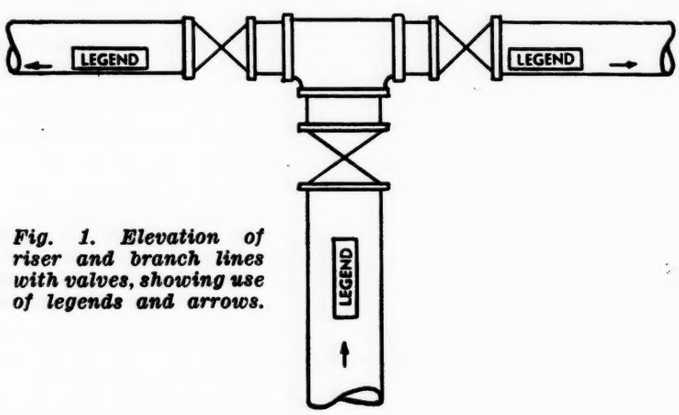

Fig. 1. Elevation of riser and branch lines with valves, showing use of legends and arrows.

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How to Estimate the Amount of Water Vapor Transmitted Through Building Walls

There is a considerable need for data on estimating the amount of water vapor transmitted through building walls when condensation does not take place. This article is an attempt to provide such data. Due to the fact that methods of determining water vapor transmission through materials are not standardized and because the procedures employed by various investigators vary considerably, the information available is not entirely consistent. However, the figures presented in this article will enable the engineer to make an estimate of the amount of vapor transmitted as accurately as present knowledge permits and therefore the article should be of considerable help. Most of the data in this article are based on the research work done by J. D. Babbitt, H. J. Barre, F. B. Rowley, A. Algren and C. Lund.

THE estimation of the amount of water vapor transmitted through building materials is of considerable importance in many branches of air conditioning work. For example, such an estimate is necessary in predicting when and how much moisture will condense in building walls or how much moisture will have to be removed from low humidity rooms in order to maintain the desired moisture conditions. At the present time most engineers are simply guessing when they are faced with a problem requiring an estimate of moisture transmission. They are forced to guess since there are few data available in a useful form which can be used for making such estimates. This article is an attempt to bring together all such information on moisture transmission and put it in usable form.

It has frequently been suggested that the amount of water vapor transmitted be estimated by a method similar to the method of estimating transmitted heat. If this idea is used it would mean that a series of moisture transmission tables for common building construction could be prepared similar to those in wide use for estimating heat transmission. The use of such a method would assume that the flow of moisture through building materials would be similar to the flow of heat in that the amount of moisture transmitted would be proportional to the vapor pressure difference just as the flow of heat is proportional to the temperature difference.

Recent experiments have showed that, while this is not exactly true for relative humidities of 75 to 80% or below, the error introduced by this assumption is not very great and gives results accurate enough for estimating purposes. For relative humidities over 80% the flow of water vapor is apparently not proportional to the vapor pressure, but to the relative humidity. For this reason such a method can be used only for relative humidities of 75% or less. Since most installations fall into this class this limitation should not be serious.

Vapor Transmission Coefficients

Before this method can be used it is necessary to know the apparent vapor transmission coefficient for materials encountered in ordinary building construction. A number of investigators have recently conducted many tests on common building materials to determine how much water vapor was transmitted through them. However, the data are not at all consistent since the methods and apparatus used by the investigators vary considerably. In many cases the investigators used relative humidities over 75% thus making the information useless for estimating vapor transmission below 75%.

The data which are most useful in setting up vapor transmission tables were obtained by J. D. Babbitt of the National Research Council of Ottawa, Canada, H. J. Barre of the Iowa State Agricultural Experiment Station, and F. B. Rowley, A. Algren, and C. Lund of the University of Minnesota. Practically all of the data in this article are taken from the reports of these investigators.

Table 1 shows the vapor transmission coefficients and the resistances for a large number of ordinary building materials. These coefficients are expressed in grains of water vapor transmitted in an hour through a square foot of surface area for a pound per square inch of vapor pressure difference for the thickness indicated. It will be noticed that the coefficient for many materials show a considerable variation; for example, ¼ in. Douglas fir plywood has a coefficient of 3.96 to 9.07 gr per sq ft per hr per lb per sq in. of pressure difference. This considerable variation is probably due to the fact that the test methods are not standardized as yet and also that the individual samples of plywood vary considerably in regard to vapor transmission. The work of Babbitt in particular showed that there are very large variations in supposedly similar materials made by the different manufacturers or even by the same manufacturer. Therefore anyone using these data must keep in mind the fact that no accurate estimates can be made. The best that can be hoped for is a rough estimate which will give the engineer something to guide him in selecting the equipment and will be at least better than complete lack of information which he had to work with in the past.

Vapor Flow Through Slits

In many installations where vapor barriers such as aluminum and other metal foils, asphalt paper and

TABLE 1—WATER VAPOR TRANSMITTED THROUGH VARIOUS BUILDING MATERIALS†

Material*	Thickness, Inches	Permeability: Grains per Sq Ft per Hr per Lb per Sq In. Vapor Pressure Difference	Vapor Resistance (Reciprocal of Permeability)
Air			
Still Air	1.0	257.0	0.004
Still Air	3.625	70.9	0.014
Building Felts			
Asphalt Saturated Asbestos			
15 lb*	0.028	26.6	0.038
20 lb,. one surface asphalt coated	0.032-0.034	0.28 - 0.34	2.92 - 3.56
50 lb. saturated—not coated	0.051	0.77	1.43
Asphalt Saturated Rag			
10 lb	0.025	2.0 - 12.9	0.078- 0.5
15 lb	0.033-0.038	2.16 - 6.16	0.16 - 0.46
20 lb	0.035-0.039	0.925- 1.02	0.98 - 1.08
25 lb	0.050-0.061	51.8 - 62.8	0.016- 0.019
30 lb	0.060-0.068	1.05- 12.8	0.078- 0.95
Johns-Manville, 30 lb			
One sheet	0.062	3.65	0.274
Two sheets	—	2.36	0.423
Three sheets	—	1.87	0.535
Asphalt Saturated and Coated			
Regal coated, one surface, 20 lb	0.038	0.43	2.32
Super-regal, coated one surface, 25 lb	0.031	0.58	1.72
Supertite sheathing, coated both surfaces			
Light	0.036	0.28	3.58
Heavy	0.045	0.185	5.4
Light, coated both surfaces, 15 lb	0.036	0.34	2.94
Super, coated both surfaces, 18 lb	0.045	0.123	8.14
Base felt, coated both surfaces, 42 lb	0.074	0.154	6.5
Coated one surface	0.036	0.308	3.25
Carpet Felt			
17 oz	0.056	339.0	0.003
Tar Saturated Asbestos			
15 lb	0.029	3.42	0.292
Tar Saturated Rag			
12.5 lb (7 oz)	0.028-0.032	1.36 - 57.0	0.018- 0.735
15 lb (10 oz)	0.030-0.042	11.6 - 78.5	0.013- 0.086
25 lb (16 oz)	0.047-0.060	2.44 - 69.0	0.015- 0.42
Concrete			
Concrete			
Plain	1.5	3.57	0.28
With two coats asphalt	1.5	3.18	0.314
Insulation			
Loose			
Rockwool	1.0	51.9 -468.0	0.002- 0.019
Board			
Celotex insulating lath	0.50	58.1	0.017
with one coat aluminum paint	0.50	13.9	0.072
with two coats aluminum paint	0.50	0.72	1.39
Celotex vapor seal sheathing	0.78	3.99	0.25
Homosote	0.50	38.8	0.026
with one coat aluminum paint	0.50	24.6	0.041
with two coats aluminum paint	0.50	0.0	∞
Johns-Manville rock cork	0.523	6.02	0.166
	0.984	4.95	0.202
	2.001	4.08	0.245
Nu-wood	0.50	86.3	0.015
Pressed corkboard	0.905-0.985	4.74 - 5.42	0.21 - 0.184
Manufactured Boards			
Fiberboard			
Plain	1.06	38.0	0.026
Plain	0.83	43.4	0.022
Plain	0.599	56.4	0.018
Plain	0.492	60.6	0.016
Plain	0.405	74.5	0.013
Plain	0.201	133.2	0.007
Dipped asphalt one surface	0.633	17.3	0.058
Rolled asphalt one surface	0.492	8.0	0.125
Two ½ in. samples joined with asphalt	0.985	2.74	0.365
Laminated, 6 layers fiberboard, 5 layers of asphalt	0.527	0.231	4.32
Johns-Manville Flexboard	0.125	11.8	0.085
Masonite			
Presdwood (Tempered)	0.13	9.75	0.103
Presdwood	0.13	21.7	0.046
5 thicknesses	—	6.25	0.16
7 thicknesses	—	4.80	0.208
Plasterboard			
Plaster between paper	0.37	70.3	0.014
Plywood			
Douglas Fir (G_{25})	0.25	7.48 - 9.07	0.11 - 0.134
	0.375	9.2	0.109
with two coats white lead paint	0.25	3.96	0.252

(Continued on next page)

TABLE 1. *(Continued)* WATER VAPOR TRANSMITTED THROUGH VARIOUS BUILDING MATERIALS†

Material*	Thickness, Inches	Permeability: Grains per Sq Ft per Hr per Lb per Sq In Vapor Pressure Difference	Vapor Resistance (Reciprocal of Permeability)
Paint Films Only			
Aluminum Bronze (Bronzing liquid vehicle)			
On plaster, two coats	—	7.17	0.139
On plaster, three coats	—	3.20	0.312
Aluminum Paint (Varnish vehicle)			
On Celotex insulating lath, one coat	—	18.2	0.055
On Celotex insulating lath, two coats	—	0.73	1.373
On Homosote, one coat	—	66.6	0.015
On Homosote, two coats	—	0.0	∞
On Pine, one coat	—	7.15	0.14
On Pine, two coats	—	1.07	0.93
On Pine, three coats	—	0.80	1.25
On Plaster, two coats	—	3.58	0.279
On Plaster, three coats	—	1.85	0.541
Asphalt			
On Concrete, two coats	—	29.4	0.034
Enamel, white (Varnish vehicle)			
On Pine, one coat	—	9.10	0.11
On Pine, two coats	—	2.54	0.39
On Pine, three coats	—	1.85	0.54
On Plaster, two coats	—	2.76	0.362
On Plaster, three coats	—	2.16	0.463
Flat white			
On Cedar, three coats	—	4.67	0.214
On Plywood, two coats	—	8.48	0.118
Flat Interior, white (Linseed Rosin Vehicle)			
On Plaster, two coats	—	5.20	0.192
On Plaster, three coats	—	3.65	0.274
Flat Interior, white (Rosin Perrilla Oil Vehicle)			
On Plaster, two coats	—	2.38	0.42
On Plaster, three coats	—	2.47	0.404
Interior-Exterior Paint (Linseed Vehicle)			
On Plaster, two coats	—	7.00	0.143
On Plaster, three coats	—	2.33	0.428
Seal Coat, white (Varnish Vehicle)			
On Plaster, two coats	—	3.77	0.365
On Plaster, three coats	—	2.29	0.436
Semi-gloss Interior, white (Linseed Tung Vehicle)			
On Plaster, two coats	—	5.02	0.199
On Plaster, three coats	—	3.56	0.281
Paper			
Asbestos			
14 lb	0.28	321.0	0.003
Asphalt Coated Kraft (not saturated)			
Heavy, 4.8 lb	0.013	0.83 - 1.51	0.66 - 1.2
Asphalt Saturated and Coated Kraft			
9 lb	0.013-0.018	0.38 - 0.99	1.01 - 2.64
Asphalt Saturated Sheathing			
No. 2, 6.25 lb	0.015-0.017	0.29 - 32.7	0.03 - 3.45
Renown, 6.25 lb	0.017	8.50	0.118
Kraft, 6.25 lb	0.015	3.14	0.32
Kraft			
1 sheet	0.004	159.5	0.006
2 sheets	—	101.5	0.01
3 sheets	—	76.0	0.013
4 sheets	—	60.4	0.016
5 sheets	—	50.8 - 61.8	0.16 - 0.02
7 sheets	—	36.3 - 43.1	0.222- 0.027
8 sheets	—	31.4 - 36.3	0.275- 0.032
Kraft (Waxed)			
Light, 2 lb	0.003-0.004	0.216- 2.43	0.412- 4.63
Medium, 2.8 lb	0.005-0.006	0.31 - 0.74	1.35 - 3.22
Heavy, 4 lb	0.007	1.11 - 9.9	0.1 - 0.9
Kraft (Asphalt Infused)			
Waxed, ribbed, one surface infused	0.006	1.05	0.95
Waxed, ribbed, one surface infused	0.007	1.05	0.95
Waxed, one surface infused	0.009	0.89	1.12
Unwaxed, one surface infused	0.005	1.66	0.6
Red Rosin Sheathing			
Plain	—	123.1	0.008
Roofing			
Base Sheet, 39 lb	0.076	0.71	1.42
Cap Sheet, 39 lb	0.080	0.15	6.66
Janus, light, 32 lb	0.052	0.18	5.55
Janus, medium, 42 lb	0.066	0.15	6.66
Janus, heavy, 51 lb	0.073	0.12	8.34
Janus, extra heavy, 60 lb	0.105	0.18	5.55
Janus, super heavy, 69 lb	0.115	0.06	16.7
Talisman, medium, 42 lb	0.073	0.12	8.34
Talisman, heavy, 51 lb	0.088	0.12	8.34
Talisman, extra heavy, 60 lb	0.109	0.28	3.57
Talisman, super heavy, 69 lb	0.126	0.22	4.55
Tar Saturated Sheathing			
No. 2, 6.25 lb	0.016-0.018	20.2 - 46.2	0.216- 0.05
11 lb	0.032-0.040	25.0 - 37.9	0.264- 0.04
12.5 lb	0.031	50.8	0.02

(Continued on next page)

TABLE 1. *(Concluded)* WATER VAPOR TRANSMITTED THROUGH VARIOUS BUILDING MATERIALS†

Material*	Thickness, Inches	Permeability: Grains per Sq Ft per Hr per Lb per Sq In Vapor Pressure Difference	Vapor Resistance (Reciprocal of Permeability)
Paper *(Cont.)*			
Waxed			
Light, 2 lb	0.004	0.25 - 2.28	4.0 - 0.438
Medium, 2.8 lb	0.005-0.006	0.83 - 5.54	0.18 - 1.19
Heavy, 4 lb	0.007-0.008	2.71 - 6.65	0.15 - 0.37
Plaster			
Plaster			
½ in. on metal lath	—	32.5	0.031
¾ in. on metal lath	—	27.4	0.036
1 in. on metal lath	—	22.5	0.044
½ in. on wood lath	—	13.7	0.073
½ in. on ⅜ in. gypsum board	—	22.9	0.044
½ in. on ½ in. wood fiber board	—	33.3	0.030
Solid plaster	1.34	27.1	0.037
Wood			
Cedar			
Siding	—	3.69	0.271
Siding with three coats white lead paint	—	2.06	0.485
Pine			
Unpainted	0.80	1.88	0.53
Unpainted	0.645	2.52	0.40
Unpainted	0.496	3.45	0.29
Unpainted	0.315	5.64	0.177
Unpainted	0.169	9.64	0.104
Spruce			
Unpainted	0.563	3.48	0.288
Unpainted	0.480	4.04	0.248
Unpainted	0.405	3.94	0.254
Unpainted	0.323	4.93	0.202
Unpainted	0.232	7.24	0.138
Unpainted	0.161	10.7	0.093
Miscellaneous			
Ground cornstalks	2.0	85.5	0.0117
Hole (1/16 in.) in sheet metal	—	0.85	1.17
Metal, sheets	—	0.0	∞
Water surface, free standing	—	1238.0	0.0008

*All weights refer to pounds per 100 sq ft.

†Compiled from reports of various investigators, including those of J. D. Babbitt of the National Research Laboratories, Ottawa, Canada; F. B. Rowley, A. B. Algren and C. E. Lund of the Engineering Experiment Station, University of Minnesota, Minneapolis, Minn.; and H. J. Barre of the Agricultural Experiment Station, Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa.

similar materials are used, the vapor transmission coefficient for the material will not give a true indication of the actual amount of vapor transmitted through the wall due to the fact that small cracks or slits are left at the places where the material is joined. Babbitt has done a considerable amount of work estimating the amount of vapor transmitted through these slits and the results of this work expressed in terms we are interested in are given in Table 2. While work was done principally with aluminum foil barriers, there is no reason to believe that the figures in Table 2 will not apply to other types of vapor barriers.

The data given in Tables 1 and 2 are used in much the same manner as heat transmission conductivity data.

TABLE 2—WATER VAPOR TRANSMITTED THROUGH SLITS IN VAPOR BARRIERS†

Width of Slit, Inches	Aluminum Foil Between Two Sheets of ⅜ In. Plasterboard	Aluminum Foil Between Two Sheets of ½ In. Fiberboard	Aluminum Foil Backing on ⅜ In. Plasterboard Sheet	Aluminum Foil Backing on ⅜ In. Plasterboard Sheet and ½ In. Plaster
	Moisture Transmitted Gr. per Hr per Lineal In. of Crack per Lb per Sq In. Vapor Pressure Difference			
0.02	0.142	0.203	0.219	0.110
0.04	0.169	0.234	0.254	0.126
0.06	0.189	0.256	0.280	0.137
0.08	0.208	0.276	0.302	0.147
0.10	0.225	0.292	0.322	0.156
0.12	0.241	0.308	0.340	0.164
0.14	0.257	0.322	0.357	0.171
0.16	0.272	0.336	0.373	0.178
0.18	0.287	0.348	0.388	0.184
0.20	0.302	0.360	0.403	0.190
0.22	0.316	0.372	0.418	0.196
0.24	0.332	0.384	0.433	0.202
0.26	0.347	0.396	0.447	0.208
0.28	0.362	0.407	0.460	0.213
0.30	0.377	0.419	0.475	0.218

†Compiled from report of tests by J. D. Babbitt of the National Research Laboratories, Ottawa, Canada.

Note: For converting data similar to those in this table from metric to English units, multiply grains per 24 hours per centimeter slit length per millimeter of mercury pressure difference by 84.4 to obtain grains per hour per inch of slit length per pound per square inch pressure difference.

TABLE 3—VAPOR PRESSURE OF WATER VAPOR IN AIR

Dry Bulb Temperature, F	Vapor Pressure, Lb per Sq In.	Dry Bulb Temperature, F	Vapor Pressure, Lb per Sq In.
—20	0.0062	72	0.389
—15	0.0082	73	0.401
—10	0.0108	74	0.415
— 5	0.0142	75	0.429
0	0.0185	76	0.444
5	0.0240	78	0.475
10	0.0310	80	0.506
15	0.0397	85	0.606
20	0.0505	90	0.698
25	0.0641	95	0.815
30	0.0809	100	0.948
32	0.0885	105	1.100
35	0.1000	110	1.274
40	0.1220	115	1.470
45	0.1478	120	1.693
50	0.1785	125	1.940
55	0.2143	130	2.17
60	0.2564	135	2.54
62	0.276	140	2.88
64	0.296	145	3.28
65	0.306	150	3.72
66	0.317	155	4.20
67	0.328	160	4.74
68	0.340	170	5.99
69	0.352	180	7.50
70	0.363	190	9.33
71	0.375	200	11.55

That is, when it is desired to find the amount of moisture transmitted through any given building wall the moisture resistances are added together to find the total resistance of the wall. This resistance is then divided into one in order to determine the moisture transmission coefficient. Expressing this as a formula

$$M = \frac{1}{R_1 + R_2 + R_3 + \ldots}$$

where M is the amount of moisture transmitted through a unit area of the wall and R_1, R_2, etc., are the resistances of the separate materials making up the wall.

Where the coefficient listed in the table is not for the thickness desired it is possible to determine the new coefficient by multiplying the given coefficient by the thickness shown and dividing the result by the desired thickness. This, then, will give the moisture transmission coefficient for the desired thickness of material.

Estimating Vapor Transmission

The amount of water vapor transmitted through the building construction can be estimated by multiplying this coefficient by the area expressed in square feet and by the vapor pressure difference across the construction.

The vapor pressure difference is obtained from standard psychrometric tables or from Table 3 which is abstracted from one such table. The vapor pressure difference is obtained simply by subtracting the lower vapor pressure from the higher pressure. For example, suppose it is desired to find the vapor pressure difference where a room is maintained at 70F and 10% relative humidity when the outside conditions are 90F and 50% relative humidity. At 90F and 100% relative humidity the vapor pressure is 0.698 lb per sq in. so that at 90F and 50% the vapor pressure is

$$.50 \times 0.698 = 0.349 \text{ lb per sq in.}$$

At 70F and 100% relative humidity the vapor pressure is 0.363 lb per sq in. so that at 70F and 10% relative humidity it is

$.10 \times 0.363 = 0.0363$. Therefore, the vapor pressure difference is

$$0.349 - 0.0363 = 0.3127 \text{ lb per sq in.}$$

The formula for the amount of water vapor transmitted through a building wall is similar to the formula for heat flow and can be expressed as

$$W = M\,A\,(P_1 - P_2)$$

where W is the total water vapor flow in grains in one hour across the wall, M is the moisture transmission coefficient of the wall in grains per square foot per hour per pound per square inch vapor pressure difference, A is the area of the wall in square feet, P_1 is the vapor pressure on the one side and P_2 is the vapor pressure on the other side, both expressed in pounds per square inch.

Example

Following is an example which shows how the data in this article may be used.

Problem: Find the amount of water vapor transmitted through a wall of a room which is maintained at 70F and 10% relative humidity when the outside conditions are 90F and 50% relative humidity. The area of the wall is 100 sq ft and the wall is constructed of unpainted pine 8/10 in. thick; red rosin sheathing paper; 2 × 4's with the space filled with loose rock wool; kraft asphalt saturated sheathing paper 6.25 lb per 100 ft; ½ in. plaster on wood lath painted with two coats of flat interior white linseed oil paint.

Solution: The vapor transmission coefficient is obtained by adding the vapor resistances of the various materials and then taking the reciprocal of the sum. See Table 1.

Material	Resistance
Unpainted pine	0.53
Red rosin sheathing paper	0.008
Rockwool, 3⅝ in. (betw. 2 x 4's)	0.007
Kraft asphalt saturated sheathing paper	0.32
Plaster on wood lath	0.073
Two coats flat linseed oil paint	0.192
	1.130

Therefore the total vapor resistance of the walls is 1.130 and the vapor transmission coefficient is $\frac{1}{1.130}$ = 0.885 grains per sq ft per hr per lb per sq in. vapor pressure difference.

The vapor pressure difference is the same as calculated in the previous example and is 0.3127 lb per sq in. Therefore the total water vapor transmission through the wall can be obtained by substituting in the formula

$$W = MA\,(P_1 - P_2)$$

Therefore

$W = 0.885 \times 100$ sq ft $(0.349 - 0.0363)$
$W = 0.885 \times 100\ (0.3127)$
$W = 27.5$ gr per hr.

Therefore the amount of water vapor transmitted through this wall is approximately 27½ grains per hour.

A Null-Type Instrument for Measuring Low Air Velocities

By LESLIE SILVERMAN

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IN a recent investigation by the author, it was necessary to measure low-velocity air currents due to convection from heated tank surfaces. Because of the presence of high fluctuating temperatures, it was not possible to use heated-type instruments, such as the hot-wire or heated thermometer anemometers. A very simple device, designed to measure vertically ascending currents, but which can easily be modified to measure velocities in any direction and of any magnitude, was built and found to give good results in the range of desired measurements (20 to 60 feet per minute).

The device consists of a fixed orifice tube above which is suspended a thin aluminum vane mounted on a beam which is counter-balanced. Fig. 2 shows the apparatus schematically. A very simple bearing consisting of a drilled hole on the aluminum beam rotating on a small drill rod proved satisfactory. Small guides mounted near the vane took care of side play and acted as a stop. More precise bearings would obviate the use of these guides. However, a stop is desirable. The vane is balanced by means of a light rider, whose weight can be varied for different ranges. The instrument is constructed of thin brass sheet and tubing. For use in measuring horizontal currents, the balancing beam should extend perpendicularly from the pivot.

Calibration of the unit can be done with a large dry meter or spirometer or by means of a wind tunnel. It is easily shown that the velocity is proportional to the square root of the balancing point (distance from pivot) for a given weight rider. A calibration can thus be performed at one velocity and the other points calculated. Fig. 1 shows a calibration in which several points were obtained by mounting the opening over the exit port of a large dry meter which was calibrated with a spirometer. The effect of temperature may be corrected for by means of the formula:

$$V = 60\sqrt{\frac{Rag}{KdAl}}$$

where V is the velocity in feet per minute, R the weight of rider in pounds, a the length of weight from center of balance in feet, g the acceleration of gravity (32.2 ft per sec per sec), K the proportion of impact pressure used in balancing beam and vane expressed as a decimal, d the air density in pounds per cubic foot, A the vane area in square feet and l the length of center of vane to balance point in feet.

Because of the low velocities measured, no damping was necessary, although at high velocities some damping may be needed. Variation in flow range can be obtained by two means. One method, already mentioned, is by the use of different weight riders and the other by the use of different restricting orifices. A possible field adaptation of the instrument using an adjustable orifice to balance the vane is under consideration. By these means, it should be possible to extend the range of the instrument from low to very high velocities.

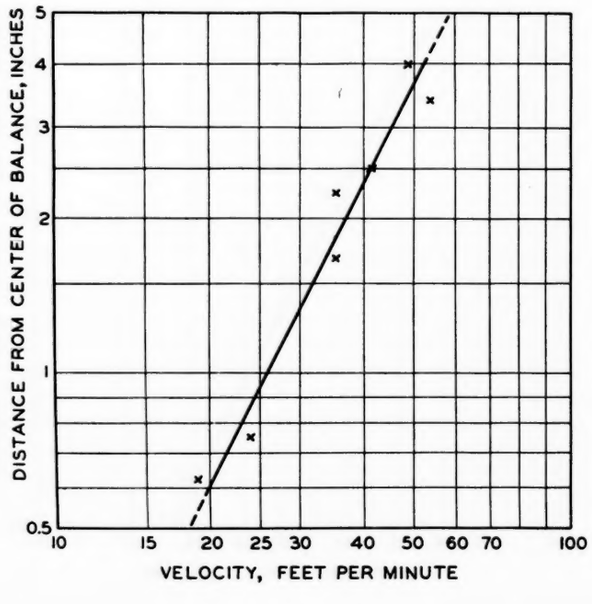
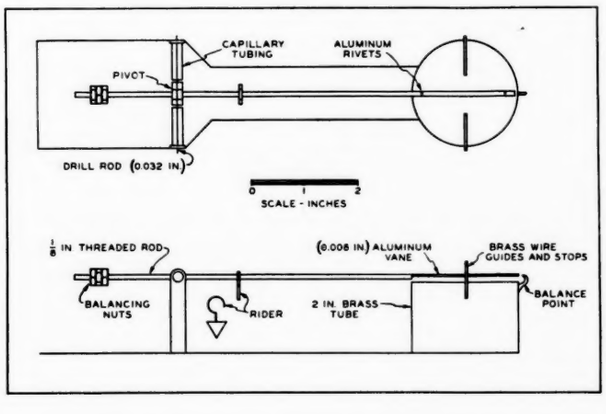


Fig. 1. (Left) Calibration of instrument at 70F by means of a large dry meter. Rider weight, 0.7 grams.
Fig. 2. (Below) Schematic diagram of measuring instrument.



PIPING

Thickness of Insulation Required to Prevent Sweating on Cold Pipe Lines

By R. N. HOSEY
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WHEN pipes carrying refrigerants, ice water, or other cold fluids come in contact with surrounding air, the dewpoint of which is higher than the temperature of the pipe, condensation of water vapor, or sweating, occurs. This condensation usually is objectionable because the drippage may cause damage to floors and machinery, or to valuable goods stored underneath the pipes, or because corrosion of the pipe surface is accelerated through the action of oxygen or other active gases which dissolve in the film of condensation. Quite often important, too, is the increased rate of refrigeration loss resulting from the greater effectiveness of the wet surface, as compared with a dry surface, in promoting heat transfer between air and pipe. Absorption of the latent heat liberated from the condensing moisture adds further to this loss of cold effect.

Condensation can be prevented by application of insulation of such a thickness that its outside surface will not be chilled below the dewpoint temperature of the surrounding air. This thickness can be calculated by use of the formula and chart discussed later in this article. Table 1 gives a list of such calculated thicknesses for a rather wide range of pipe sizes, air temperatures and humidities, fluid temperatures, and heat transfer coefficients. This table, it is hoped, will serve a useful purpose in enabling the user to tell at a glance the proper thickness of insulation to use to provide anti-sweat protection for any set of conditions normally encountered. Common practice of insulation manufacturers in rating their products seems to be to classify them as being suitable for certain minimum liquid temperatures, with nothing being specified about air temperature and humidity. For instance, one well-known type of cold insulation in the grade known as "Brine Thickness," ranging in thickness from 1.70 to 3.00 in., is stated to be good for liquid temperatures down to 0F. Actually, it may be good for much lower temperatures than this if the dewpoint of the air happens to be relatively low; like wise, it may not be suitable for the specified low temperature if the dewpoint is higher than that on which the stipulated performance is based. If the coefficient of heat transfer is known, the minimum thickness for any kind of insulation to meet any specific conditions can be computed, as has been done in Table 1.

The use of the tables is illustrated by the following example:

What thickness of molded rockwool insulation will be necessary to provide anti-sweat protection to a 2 in. pipe line carrying 20F brine when the surrounding air temperature is 90F and the relative humidity 70%?

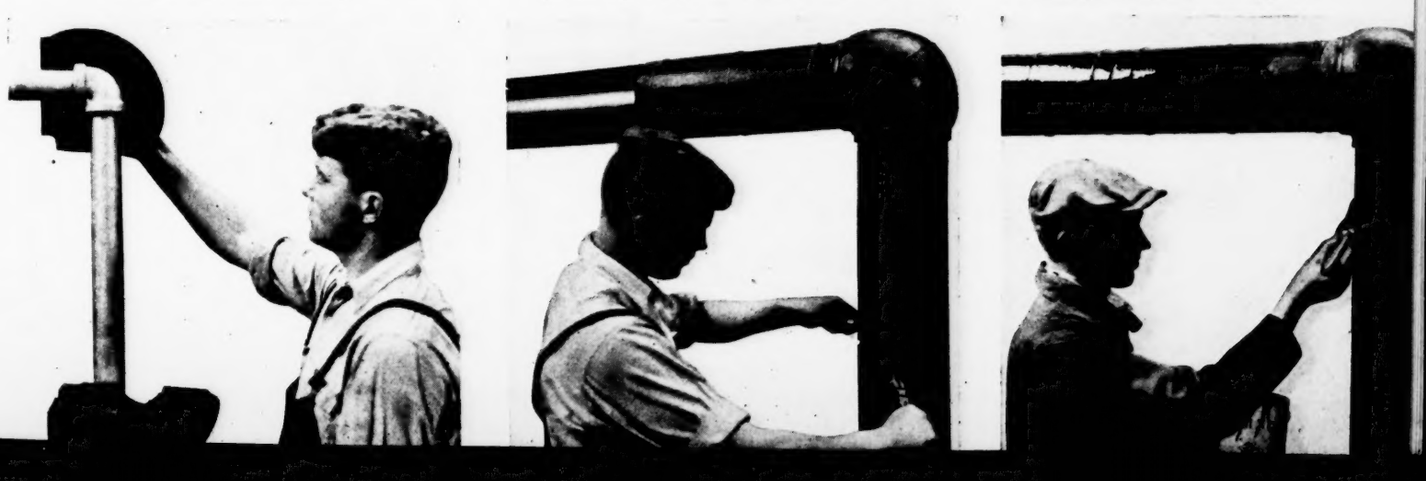
Solution: Table 2 shows k for molded rockwool to be .025 to .027. Assume the mean, or .026. Table 1 then gives, for 20F brine, 2 in. pipe, air at 90F temperature and 70% relative humidity, and for a k value of .024, a required minimum thickness of 1.60 in. For a k value of .029, the thickness is 1.85 in. Interpolation shows the thickness for rockwool with a k value of .026 to lie 2/5 of the way between 1.60 and 1.85, or 1.70 in.

A number of different types of cold insulation are available and widely used for this purpose. These employ various kinds of materials, and are made up in more or less standard shapes, lengths, and thicknesses, with a variety of application and fastening methods employed by the different manufacturers. But all high grade anti-sweat insulations have one thing in common — their provision for preventing the entrance of water vapor through the surface. If vapor penetrates the surface and progresses inwardly, condensation will occur wherever the dewpoint temperature is reached, which may be either in the body of the insulation or on the pipe. The result in either case is water-soaked insulation, which means that its effectiveness is destroyed, or that the insulation may actually be

Applying molded cork insulation to standard screwed fitting.

The molded sections of cork are held in place by loops of copper clad wire.

After smoothing with seam filler, waterproof paint is applied.



Above: Felted mineral wool, then waterproof tape and finally plastic waterproof cement are used for fittings in rock cork covered lines.

Left: Applying standard molded sections of rock cork to cold piping.

ruined completely by freezing and bursting. Thus, the importance of having a surface impervious to water vapor is apparent.

Cork is one such material commonly used for cold line insulation. Granules of the pure cork are highly compressed into molds and then baked. The baking process liquefies the natural resin and this acts as a binder which cements the particles together. The molded sections are made in standard lengths of three feet and in three standard thicknesses, known as (a) Ice Water, ranging from 1.20 to 1.93 in., (b) Brine, from 1.70 to 3.00 in., and (c) Special Thick Brine, from 2.52 to 4.00 in. Standard molded sections are available for pipe diameters up to 8 in. Molded shapes for the covering of standard screwed and flanged fittings also can be had. Screwed fittings usually are covered first, the balance of the piping afterward; with flanged fittings, the procedure is reversed. All joints are filled with a waterproof cement at the time of making, and seams and crevices puttied before applying a final coat of waterproof asphaltic paint. Outside lines have a covering of roofing paper for added protection. Copper clad steel wire usually is looped around the molded sections during the installation to hold them in place. Where insulated lines rest in hangers, sheet iron semi-cylindrical shields about 6 in. long are used as rests to protect the insulation against crushing.

Much of the above application procedure applies also to rockwool when used for cold line covering. The loose wool, impregnated with a waterproof binder, is molded into half-sections 3 ft long, encased in a waterproof jacket, the extended flap of which is cemented down to complete the longitudinal joint. End joints of the sections are filled with waterproof cement and sealed with waterproof tape. Sheets of felted rockwool impregnated with asphalt are used for covering valves and fittings. Waterproof tape is used to cover this, and a seal coat of waterproof cement is applied over the tape. The standard pipe sections come in three thicknesses, as follows: (a) Ice Water, ranging from 1.4 to 2.0 in., (b) Brine, from 1.97 to 3.19 in., and (c) Heavy Brine, from 2.82 to 4.0 in.

Hair felt insulation, made from cattle hair, comes in rolls 50 ft long, in widths of 3 to 9 ft. Standard thicknesses run from ¼ in. to 2 in., and special light weights up to 3 in. in diameter are available. It is wrapped about cold lines to give built-up thicknesses as required, then covered with waterproof tape and cement.

Wool felt for cold line insulation is made up of flat wool felt protected by layers of waterproofed felt. It is made in sections 3 ft long for standard pipe sizes up to 6 in. It comes in single layer thicknesses up to ¾ in. and in double layers up to 2 in. Joints are waterproofed and the wool covered with a canvas jacket. Metal bands cover the joints between sections.

Several other types of anti-sweat insulations are available, but the same general principles govern their properties and applications as govern those just discussed.

The thicknesses shown in Table 1 were calculated by use of the formula below, and by reference to Chart I. The derivation of the formula and a table of chart values for K_2 up to 5, are given in "Applied Heat Transmission," by Prof. H. J. Stoever of Iowa State College. The writer extended the values of K_2 up to 20 in order to reach the corresponding higher values of the ratio $\frac{r_2}{r_1}$.

$$K_2 = \frac{8k}{r_1} \frac{(t_d - t_w)}{(t_a - t_d)}$$

TABLE I.—THICKNESS OF INSULATION REQUIRED FOR PREVENTION OF SWEATING ON COLD PIPE LINES
(For 0F and 20F Liquid Temperatures)

Liquid Temperature	Pipe Size, In.	k*	Air Temperature, F														
			60			70			80			90			100		
			Relative Humidity, %														
			50	70	90	50	70	90	50	70	90	50	70	90	50	70	90
			Thickness of Insulation, In.														
0F	½	.024	.65	1.26	3.55	.73	1.41	3.87	.83	1.51	4.17	.89	1.64	4.50	.95	1.72	4.71
		.029	.74	1.43	4.03	.84	1.59	4.35	.94	1.72	4.75	1.00	1.85	5.08	1.10	1.93	5.13
		.034	.82	1.63	4.62	.95	1.81	4.96	1.06	1.96	5.38	1.15	2.09	5.76	1.22	2.20	6.01
	¾	.024	.69	1.33	3.80	.79	1.44	4.08	.87	1.60	4.43	.94	1.73	4.78	1.01	1.82	4.94
		.029	.78	1.51	4.27	.89	1.68	4.58	.98	1.80	5.00	1.06	1.95	5.37	1.14	2.06	5.57
		.034	.89	1.71	4.84	1.01	1.90	5.21	1.11	2.04	5.68	1.21	2.21	6.10	1.28	2.33	6.31
	1	.024	.71	1.40	3.98	.82	1.56	4.29	.92	1.67	4.68	.98	1.80	4.99	1.05	1.90	5.28
		.029	.81	1.57	4.50	.92	1.74	4.83	1.02	1.88	5.24	1.11	2.04	5.61	1.18	2.16	5.82
		.034	.94	1.79	5.09	1.05	2.01	5.47	1.16	2.14	5.99	1.26	2.32	6.37	1.36	2.44	6.64
	1¼	.024	.73	1.47	4.21	.85	1.64	4.52	.95	1.77	4.89	1.03	1.90	5.26	1.11	2.01	5.47
		.029	.84	1.69	4.74	.97	1.84	5.10	1.10	1.98	5.54	1.16	2.13	5.93	1.25	2.27	7.17
		.034	.97	1.88	5.38	1.11	2.10	5.78	1.21	2.26	6.27	1.32	2.43	6.71	1.42	2.57	6.97
	1½	.024	.75	1.52	4.35	.87	1.68	4.67	.96	1.81	4.86	1.06	1.97	5.43	1.13	2.08	5.67
		.029	.86	1.70	4.90	.99	1.91	5.27	1.09	2.06	5.70	1.19	2.22	6.11	1.28	2.33	6.36
		.034	.98	1.96	5.55	1.12	2.18	5.97	1.27	2.33	6.48	1.38	2.50	6.95	1.50	2.65	7.21
	2	.024	.77	1.59	4.56	.89	1.77	4.90	.99	1.91	5.32	1.09	2.05	5.72	1.17	2.17	5.93
		.029	.89	1.79	5.13	1.00	1.99	5.51	1.13	2.14	5.98	1.22	2.32	6.43	1.33	2.44	6.68
		.034	1.00	2.03	5.82	1.16	2.26	6.26	1.30	2.45	6.78	1.41	2.63	7.29	1.51	2.78	7.57
	3	.024	.82	1.68	4.95	.96	1.89	5.31	1.05	2.05	5.79	1.14	2.21	6.20	1.23	2.36	6.44
		.029	.96	1.85	5.61	1.11	2.17	6.04	1.22	2.36	6.55	1.31	2.53	7.04	1.43	2.67	7.30
		.034	1.08	2.20	6.33	1.24	2.48	6.82	1.37	2.68	7.41	1.49	2.85	7.97	1.61	3.03	8.25
	4	.024	.84	1.73	5.24	.97	1.96	5.60	1.08	2.09	6.12	1.24	2.31	6.57	1.26	2.43	6.76
		.029	.97	1.95	5.91	1.13	2.23	6.31	1.26	2.43	6.90	1.35	2.65	7.45	1.46	2.79	7.69
		.034	1.12	2.27	6.68	1.30	2.56	7.22	1.40	2.81	7.84	1.58	3.03	8.40	1.66	3.22	8.66
	5	.024	.85	1.81	5.51	1.03	2.00	5.91	1.17	2.20	6.43	1.25	2.59	6.90	1.33	2.53	7.15
		.029	1.00	2.06	6.23	1.14	2.31	6.67	1.28	2.48	7.23	1.39	3.06	7.87	1.50	2.87	8.07
		.034	1.17	2.36	7.03	1.33	2.67	7.57	1.48	2.89	8.22	1.61	3.12	8.82	1.73	3.31	9.18
20F	½	.024	.38	.86	2.58	.50	1.02	2.94	.61	1.17	3.32	.69	1.29	3.66	.75	1.47	3.91
		.029	.43	.97	2.91	.58	1.12	3.31	.67	1.32	3.73	.77	1.46	4.12	.86	1.60	4.38
		.034	.50	1.09	3.30	.64	1.32	3.75	.77	1.49	4.24	.88	1.66	4.71	.97	1.81	5.00
	¾	.024	.39	.90	2.72	.53	1.09	3.07	.63	1.23	3.51	.73	1.37	3.88	.80	1.49	4.12
		.029	.44	1.03	3.07	.60	1.23	3.59	.72	1.40	4.04	.81	1.54	4.46	.91	1.68	4.62
		.034	.53	1.16	3.49	.67	1.40	3.96	.81	1.57	4.47	.93	1.75	4.94	1.03	1.91	5.26
	1	.024	.41	.95	2.86	.54	1.13	3.24	.65	1.29	3.68	.75	1.44	4.07	.83	1.56	4.33
		.029	.46	1.06	3.23	.60	1.29	3.66	.75	1.45	4.15	.84	1.61	4.60	.95	1.76	4.87
		.034	.55	1.21	3.65	.69	1.45	4.15	.84	1.66	4.71	.97	1.82	5.20	1.06	2.00	5.52
	1¼	.024	.43	.98	3.01	.57	1.19	3.42	.66	1.36	3.89	.77	1.49	4.29	.86	1.65	4.58
		.029	.47	1.12	3.40	.62	1.34	3.87	.76	1.54	4.36	.87	1.71	4.85	.99	1.85	5.16
		.034	.56	1.27	3.85	.72	1.52	4.38	.87	1.74	4.96	1.00	1.92	5.45	1.12	2.10	5.84
	1½	.024	.43	1.00	3.10	.57	1.21	3.53	.67	1.39	4.00	.79	1.53	4.43	.88	1.73	4.71
		.029	.49	1.14	3.50	.66	1.39	3.98	.77	1.57	4.51	.88	1.74	4.99	1.00	1.92	5.31
		.034	.56	1.32	3.97	.73	1.58	4.52	.89	1.79	5.14	1.03	1.99	5.65	1.16	2.18	6.04
	2	.024	.44	1.03	3.26	.58	1.33	3.70	.70	1.46	4.20	.83	1.60	4.65	.91	1.79	4.95
		.029	.49	1.17	3.65	.66	1.43	4.19	.80	1.66	4.74	.92	1.85	5.24	1.03	2.01	5.59
		.034	.57	1.35	4.17	.74	1.66	4.74	.91	1.87	5.37	1.06	2.07	5.94	1.18	2.28	6.32
	3	.024	.44	1.09	3.55	.58	1.35	4.02	.71	1.52	4.55	.84	1.69	5.04	.96	1.89	5.37
		.029	.49	1.24	4.01	.68	1.52	4.55	.84	1.75	5.35	.98	1.96	5.74	1.09	2.17	6.10
		.034	.60	1.45	4.55	.82	1.73	5.15	.98	1.99	5.85	1.10	2.24	6.47	1.26	2.50	6.91
	4	.024	.45	1.13	3.71	.58	1.39	4.25	.71	1.58	4.84	.88	1.78	5.37	.99	1.96	5.67
		.029	.52	1.29	4.23	.68	1.60	4.84	.85	1.85	5.47	1.01	2.05	6.03	1.19	2.23	6.46
		.034	.60	1.51	4.79	.83	1.85	5.45	1.01	2.07	6.18	1.17	2.32	6.84	1.29	2.57	7.31
	5	.024	.47	1.17	3.92	.58	1.44	4.48	.72	1.59	5.08	.88	1.87	5.62	1.03	2.00	6.01
		.029	.56	1.33	4.45	.70	1.64	5.03	.86	1.89	5.73	1.06	2.08	6.33	1.17	2.33	6.72
		.034	.60	1.55	5.03	.84	1.89	5.72	1.03	2.14	6.42	1.20	2.42	7.16	1.36	2.70	7.72

*Btu per hr per sq ft per F per ft of thickness.

TABLE I. *(Cont'd)*—THICKNESS OF INSULATION REQUIRED FOR PREVENTION OF SWEATING ON COLD PIPE LINES
(For 35F and 50F Liquid Temperatures)

Liquid Temperature	Pipe Size, In.	k*	Air Temperature, F														
			60			70			80			90			100		
			Relative Humidity, %														
			50	70	90	50	70	90	50	70	90	50	70	90	50	70	90
			Thickness of Insulation, In.														
35F	½	.024	.12	.50	1.72	.28	.71	2.18	.40	.88	2.62	.51	1.04	3.02	.60	1.16	3.30
		.029	.15	.56	1.94	.32	.80	2.46	.46	.99	2.96	.58	1.17	3.40	.67	1.32	3.71
		.034	.18	.65	2.21	.37	.91	2.80	.53	1.08	3.35	.66	1.33	3.87	.77	1.50	4.22
	¾	.024	.12	.52	1.82	.29	.75	2.31	.42	.93	2.77	.52	1.10	3.19	.62	1.23	3.49
		.029	.15	.59	2.06	.34	.85	2.60	.48	1.06	3.12	.60	1.23	3.59	.72	1.39	3.93
		.034	.18	.67	2.32	.38	.96	2.95	.55	1.19	3.54	.69	1.41	4.08	.82	1.58	4.45
	1	.024	.12	.52	1.91	.29	.77	2.41	.42	.95	2.90	.54	1.14	3.34	.63	1.29	3.80
		.029	.15	.59	2.15	.35	.88	2.71	.48	1.09	3.27	.62	1.29	3.91	.73	1.45	4.26
		.034	.18	.69	2.44	.40	1.01	3.10	.56	1.24	3.85	.70	1.46	4.42	.84	1.66	4.82
	1¼	.024	.13	.54	2.01	.31	.81	2.54	.44	1.01	3.05	.57	1.21	3.52	.66	1.35	3.85
		.029	.16	.62	2.27	.35	.92	2.86	.51	1.15	3.45	.63	1.36	3.97	.76	1.53	4.35
		.034	.18	.71	2.56	.43	1.05	3.26	.58	1.30	3.92	.74	1.53	4.49	.87	1.74	4.92
	1½	.024	.13	.56	2.10	.31	.81	2.61	.46	1.05	3.16	.57	1.25	3.65	.68	1.40	3.96
		.029	.16	.64	2.35	.35	.93	2.95	.51	1.18	3.55	.66	1.40	4.09	.78	1.59	4.48
		.034	.19	.73	2.65	.43	1.08	3.36	.59	1.36	4.04	.74	1.60	4.65	.90	1.80	5.11
	2	.024	.14	.57	2.16	.31	.84	2.75	.47	1.06	3.32	.59	1.27	3.82	.70	1.45	4.16
		.029	.16	.66	2.45	.35	.96	3.11	.53	1.22	3.74	.67	1.46	4.29	.79	1.67	4.71
		.034	.19	.74	2.79	.44	1.09	3.51	.61	1.39	4.23	.77	1.67	4.88	.91	1.87	5.35
	3	.024	.14	.58	2.36	.33	.91	2.99	.47	1.08	3.61	.61	1.33	4.15	.70	1.56	4.54
		.029	.18	.70	2.66	.37	1.03	3.38	.53	1.30	3.73	.70	1.56	4.69	.84	1.77	5.13
		.034	.19	.77	3.02	.44	1.17	3.85	.62	1.47	4.61	.82	1.77	5.31	.98	2.00	5.81
	4	.024	.14	.59	2.47	.33	.95	3.12	.47	1.15	3.81	.62	1.39	4.41	.70	1.60	4.84
		.029	.20	.68	2.79	.38	1.06	3.55	.56	1.33	4.30	.71	1.58	4.96	.84	1.82	5.42
		.034	.20	.80	3.21	.45	1.23	4.04	.63	1.55	4.88	.83	1.84	5.53	1.01	2.09	6.12
	5	.024	.14	.59	2.53	.34	.97	3.25	.50	1.23	3.97	.64	1.47	4.58	.72	1.67	5.03
		.029	.20	.70	2.87	.38	1.06	3.76	.56	1.39	4.53	.72	1.64	5.20	.85	1.92	5.71
		.034	.22	.80	3.34	.45	1.25	4.26	.64	1.61	5.08	.84	1.92	5.90	1.03	2.17	6.45
50F	½	.024	0	.01	.70	.01	.33	1.33	.16	.56	1.86	.31	.74	2.32	.42	.90	2.66
		.029	0	.01	.80	.02	.37	1.50	.21	.63	2.10	.35	.85	2.60	.48	1.02	3.00
		.034	0	.01	.92	.02	.43	1.70	.24	.72	2.38	.41	.96	2.97	.55	1.16	3.40
	¾	.024	0	.01	.76	.01	.35	1.41	.17	.59	1.96	.33	.79	2.54	.44	.95	2.81
		.029	0	.01	.85	.02	.40	1.59	.21	.65	2.22	.37	.90	2.76	.50	1.08	3.17
		.034	0	.01	.97	.02	.45	1.80	.24	.77	2.52	.43	1.02	3.13	.58	1.18	3.60
	1	.024	0	.01	.79	.01	.34	1.46	.18	.60	2.05	.33	.82	2.57	.46	.99	2.94
		.029	0	.01	.88	.02	.40	1.65	.21	.68	2.31	.38	.94	2.88	.50	1.12	3.31
		.034	0	.01	1.01	.02	.46	1.88	.24	.78	2.63	.44	1.06	3.28	.58	1.28	5.90
	1¼	.024	0	.01	.81	.02	.37	1.55	.19	.62	2.13	.34	.86	2.70	.47	1.04	3.10
		.029	0	.01	.91	.02	.42	1.75	.22	.71	2.43	.39	.98	3.05	.53	1.18	3.50
		.034	0	.01	1.06	.03	.47	1.99	.24	.82	2.77	.46	1.10	3.46	.60	1.35	3.97
	1½	.024	0	.01	.83	.03	.41	1.60	.19	.64	2.23	.35	.87	2.79	.48	1.07	3.20
		.029	0	.01	.93	.03	.43	1.80	.22	.72	2.51	.39	.98	3.14	.53	1.22	3.60
		.034	0	.01	1.07	.03	.50	2.05	.25	.82	2.86	.46	1.14	3.57	.62	1.39	4.10
	2	.024	0	.01	.84	.03	.34	1.67	.19	.66	2.35	.35	.89	2.93	.48	1.13	3.36
		.029	0	.01	.97	.03	.44	1.87	.23	.74	2.63	.40	1.03	3.30	.55	1.24	3.77
		.034	0	.01	1.12	.04	.50	2.13	.25	.85	2.98	.47	1.17	3.75	.63	1.42	4.28
	3	.024	0	.01	.91	.03	.36	1.75	.19	.68	2.56	.35	.96	3.15	.49	1.17	3.66
		.029	0	.01	1.05	.03	.44	2.05	.23	.79	2.87	.40	1.09	3.58	.56	1.31	4.13
		.034	0	.01	1.19	.04	.49	2.32	.26	.91	3.28	.47	1.24	3.94	.67	1.52	4.68
	4	.024	0	.01	.95	.03	.36	1.87	.20	.68	2.65	.36	.97	3.37	.49	1.24	3.87
		.029	0	.01	1.09	.03	.44	2.12	.23	.79	3.04	.43	1.12	3.80	.56	1.40	4.34
		.034	0	.01	1.24	.04	.52	2.43	.27	.95	3.44	.47	1.30	4.30	.68	1.62	4.95
	5	.024	0	.01	.97	.04	.36	1.93	.22	.70	2.73	.36	1.03	3.47	.50	1.25	4.04
		.029	0	.01	1.11	.04	.44	2.17	.25	.80	3.14	.45	1.14	3.98	.58	1.45	4.56
		.034	0	.01	1.25	.04	.56	2.50	.28	.97	3.64	.50	1.33	4.51	.70	1.67	5.23

*Btu per hr per sq ft per F per ft of thickness.

where r_1 = the inside radius of the insulation, in.,
k = the thermal conductivity of the insulation, in Btu per hour per square foot per F per foot of thickness,
t_a = the dry bulb temperature of the air, F,
t_d = the dewpoint temperature of the air, F,
t_w = temperature of the fluid in the pipe, F,
and K_2 = overall required thermal conductivity.

When K_2 is thus found, the corresponding value of the ratio r_2/r_1, where r_2 is the outside radius, can be read from Chart I. Then, with this value (v) for r_2/r_1 known, r_2 can be calculated, thus: $r_2/r_1 = v$, and $r_2 = v \times r_1$. The thickness of the insulation then is found by subtracting r_1 from r_2.

This formula is based upon assuming insulation of such a thickness that the rate of transmission of heat through the insulation just equals the rate at which heat is transmitted to the surface of the insulation from the surrounding air. The latter process is expressed by a combined coefficient which is based upon both convection and radiation. Thicknesses so derived are minimum values, or thicknesses in which the temperature of the outside surface of the insulation equals the dewpoint temperature of the air. Somewhat greater thicknesses than those shown, therefore, are necessary actually to prevent condensation.

TABLE 2.—THERMAL CONDUCTIVITIES OF PIPE INSULATORS*

Material	Density, Lb. per Cu. Ft	Thermal Conductivity, k, Btu per Hr per Sq Ft per F per Ft Thickness
Cork, regranulated, molded and baked	7.5	.021 — .024
Cork, regranulated, molded and baked	12.5	.030 — .034
Cork, regranulated, molded and baked	8.1	.026
Cork, regranulated, molded and baked	—	.030
Flaxlinum and fiberfelt..	11.2	.028
Glass wool	10	.023
Hair felt	9 - 17	.023 — .029
Rock cork	16	.028
Rock wool, molded with binder...	15	.025 — .027
Wool felt	8.5	.022 — .033
Aluminum foil, .00035 in. thick	7 foils per inch	.028

*From A.S.R.E. "Refrigerating Data Book," Marks' "Mechanical Engineers' Handbook," Ehret's "Heat Insulation Handbook," and others.

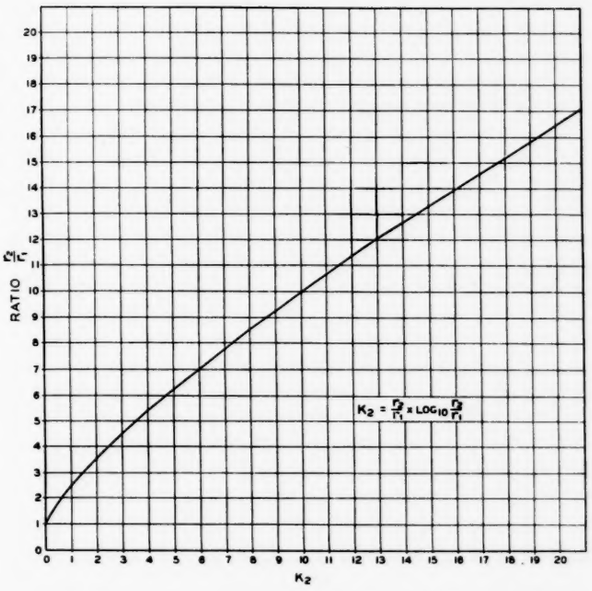


Chart I. Showing values of $\frac{r_2}{r_1}$ for various values of K_2.

Use of the formula and chart can be illustrated by solution of the previously-stated problem, the answer to which was read from Table 1:

Solution by formula: The outside diameter of a standard 2 in. pipe is 2.375 in., or 1.187 radius, which is the same as the inside radius of the insulation, r_1. The dewpoint temperature of 90F air with 70% relative humidity is 78.9F (from a psychrometric chart).

$$K_2 = \frac{8 \times .026}{1.187} \quad \frac{(78.9 - 20)}{(90 - 78.9)} = 0.93$$

From Chart I, if $K_2 = 0.93$, $r_2/r_1 = 2.43$ in.
and $r_2 = 2.43 \times 1.187 = 2.88$ in.
$2.88 - 1.187 = 1.69$ in., the minimum thickness.

The required thickness derived from Table 1 by interpolation was 1.70 in., which agrees much more closely than necessary for practical purposes. Interpolation similarly can be used on Table 1 for interlying values of air temperatures and humidities, or fluid temperatures, without serious error.

Practical Suggestions for Wartime

We are hearing and reading much these days about old machinery being reconditioned and put back to work. But we don't hear so much about those old steam engines that still can be used.

Many an old steam engine received its solar plexus blow back in the flush days when the electric motor was replacing nearly everything regardless of whether or not the electric motor was more economical. The motor was more convenient—and that was that.

Today, though, electric motors are hard to get, and as time goes on they will be growing even scarcer than they are now. Therefore, if you have an old steam engine stored away somewhere in your plant or in your back yard maybe it can be used.

The writer knows of a prominent plant in which there is a blower which was driven by an electric motor at a comparatively high rate per kilowatt hour. The motor has been removed for use elsewhere and has been replaced by a steam engine. The engine is now doing the same work as was performed by the motor and is doing so well that it is estimated the engine will pay for itself in four months.

That engine was a new one, hence its cost was considerably higher than would be the cost of an old one that could have been picked up somewhere.—*W. F. Schaphorst.*

Equivalent Rectangular Duct Sizes

By WILLIAM T. MILLER and J. NORMAN ARNOLD

Associate Professor of Heating and Ventilating, School of Mechanical Engineering, and Assistant Professor, Department of General Engineering, Purdue University, respectively.

THE accompanying nomographic chart is offered as an approximate solution for the equation

$$D = 1.265 \sqrt[5]{\frac{A^3B^3}{A+B}}$$

which is used for finding the diameter of a round duct equivalent to a given rectangular duct. In the formula D is the diameter of the equivalent round duct and A and B are the length of the long and short sides, respectively, of a rectangular duct.

The chart for equivalent diameters does not exactly solve the equation but the maximum error which may occur on scale 1 at ratios between A/B = 5 and A/B = 1 is about 2.5 per cent and the errors are on the conservative side; that is, values of D obtained are smaller than the formula gives. If scale 1 is used for values of A/B = 8, the error is near 2.5 per cent but it is larger than the formula gives. As the ratio A/B increases above 8, the error of using Scale 1 increases. Therefore, Scale 2 has been added in order to provide conservative accurate answers over the entire range of

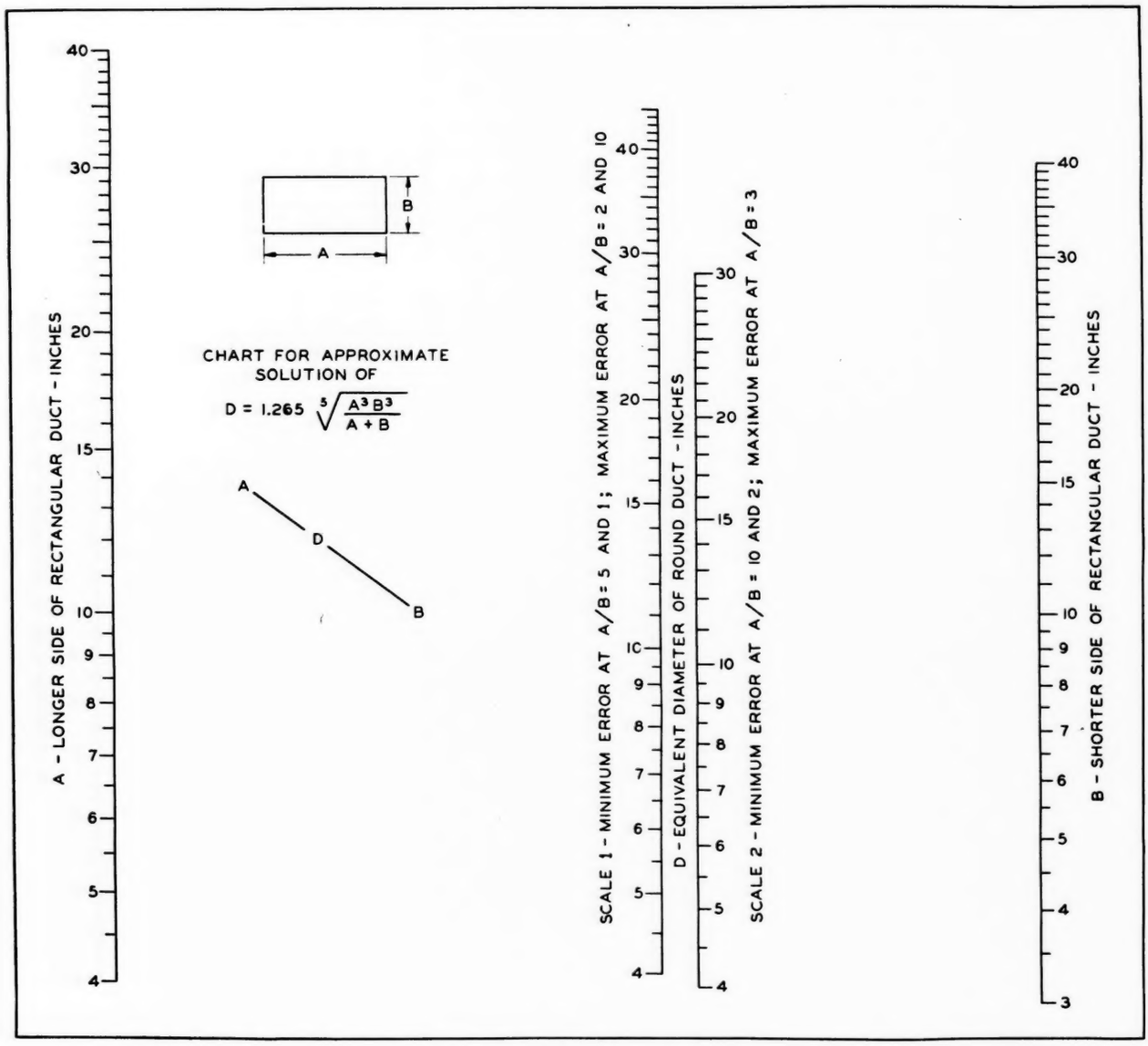

A - LONGER SIDE OF RECTANGULAR DUCT - INCHES
B
A
CHART FOR APPROXIMATE SOLUTION OF
D = 1.265 ∛(A³B³/(A+B))
A
D
B
SCALE 1 - MINIMUM ERROR AT A/B = 5 AND 1; MAXIMUM ERROR AT A/B = 2 AND 10
D - EQUIVALENT DIAMETER OF ROUND DUCT - INCHES
SCALE 2 - MINIMUM ERROR AT A/B = 10 AND 2; MAXIMUM ERROR AT A/B = 3
B - SHORTER SIDE OF RECTANGULAR DUCT - INCHES

Chart for solving problems involving conversion of rectangular to round ducts and vice-versa.

duct proportions from a square duct to a rectangular duct having A/B = 10. Consequently, it is suggested that Scale 1 be used for problems in which A/B is near 1 or near 5 while Scale 2 should be used for values of A/B near 2 or greater than 6 but not greater than 10.

Example: Assume that it is desired to find the diameter of a round duct equivalent to a rectangular duct whose long side is 24 in. and whose short side is 18 in.

SOLUTION: In this case, A/B is near 1; therefore, the answer should be read on Scale 1. Lay a straight edge from 24 on Scale A to 18 on Scale B and read 22.8 on Scale 1.

Example: Find the diameter of round duct equivalent to a rectangular duct whose sides are 24 in. and 11 in.

SOLUTION: Since A/B for this example is near 2, the answer read from Scale 2 will be more accurate. Lay a straight edge from 24 on Scale A to 11 on Scale B and read 17.4 in. on Scale 2. If Scale 1 is used instead of Scale 2, the result is 17.2, an error of about 2 per cent.

For large ratios, the error of using the wrong scale may be appreciable. For example, the correct value of D, read from Scale 2 for a duct 30 in. by 3 in., is 9.2 in. If read from Scale 1, the result is 9.7 in., an error of 5.5 per cent.

Humidity Control for Ether Fumes

Odors of ether fumes in four air conditioned operating rooms at Children's Hospital, Buffalo, are said to have been practically eliminated through controlled humidity.

It was reported that when relative humidity in the operating room is maintained at 65%, the ether fumes are very pronounced; when the humidity is dropped to 55%, the odor practically disappears.

Recently, four windowless operating rooms, equipped with complete control of temperature and humidity, were completed at Children's Hospital. A Carrier air conditioner of 15-ton cooling capacity was installed to supply cooling for the air conditioning system.

All the air for the operating rooms is drawn in from outdoors and passed through the air conditioning system which includes an electrical precipitron for removing air-borne bacteria and dusts.

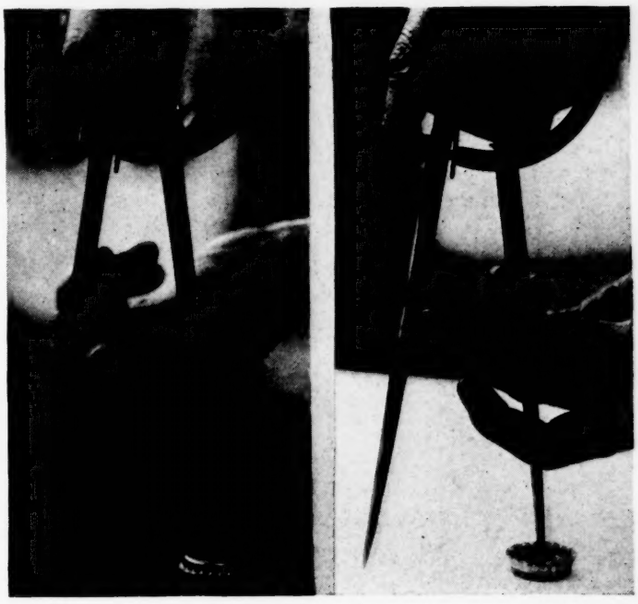
An unusual exhaust fan system and special pneumatic controls are features of the installation. Air is drawn from each of the operating rooms at the floor line, and from the ceiling of the adjoining sterilizer rooms by an exhaust fan on the roof of the building. In order to maintain a slight positive pressure within the rooms, this fan exhausts slightly less than the amount of air supplied.

Pneumatic controls in the system include a dew-point controller which operates a steam valve on a recirculating water heater and a steam valve on a pre-heat coil when temperature falls below a certain point. When operating room temperature rises above a desired level, the refrigeration machine automatically begins operation.

Bottle Cap for Divider Pivot Point

Large dividers are commonly used for scribing large circles on material from which gaskets are cut. On soft, flexible materials trouble is often encountered in holding a steady pivot point, as, for instance, with soft rubber sheeting; and the scribing point of the tool, when the circle is completed, does not always meet the point from which it started. To avoid this, make a small prick point in the top of an ordinary discarded bottle cap, lay it on the material with corrugated edge down, and use it as a pivot point. The rough points of the cap and the increased bearing area keep the point neatly in place as the instrument is turned.

On hard smooth materials where it is not permissible to deface the surface even lightly with a point, remove the small bit of cork from the cap and lay it on the smooth surface, with the inverted cap on the cork, first having made a small prick point near the inside center of the cap. The cork will keep the point from moving or slipping as the other point scribes and marks off the desired circle.



Industrial Air Conditioning Doubled in 1941 Compared with '40, Annual Report Shows

As measured in horsepower connected to electric utility lines, 1941 industrial air conditioning installations were more than double those of 1940, according to the annual Air Conditioning Report of Edison Electric Institute issued late in August. This sharp and unprecedented increase, coupled with a 7% increase in residential air conditioning, was not sufficient, however, to offset a 14% drop in commercial installations, so that the total 1941 business dropped. The total U. S. decline of 3.8% reflected a drop in installations reported from four regions, the most severe of which was a decrease of 70% in the Mountain states, but these were offset by gains in other regions headed by a 97.9% increase in the Pacific states, followed by a 29.5% rise in installations in the East South Central region. Gains and losses in 1941 installations, in horsepower, in other regions were:

New England, + 8.7%; Mid. Atlantic, — 14.8%; South Atlantic, — 11.3%; East North Central, + 0.8%; West North Central, — 14.1%; West South Central, + 1.8%.

The statistics, as reported by the Institute, covering the periods prior to 1940, 1940, 1941 and the total as of December 31, 1941, are tabulated by regions, broken down into major classifications of type, in

TABLE 1.—TOTAL REPORTED U. S. AIR CONDITIONING INSTALLATIONS BY TYPE
(From Edison Electric Institute's annual report on air conditioning)

Application	Prior to 1940		During 1940		During 1941		Total as of Dec. 31, 1941	
	No.	Hp.	No.	Hp	No.	Hp.	No.	Hp.
Residential	11,202	16,001	5,235	3,710	5,236	3,965	21,673	23,676
Commercial:								
Apartments	71	2,472	12	184	19	800	102	3,456
Banks	500	18,666	111	2,872	132	2,479	743	24,017
Barber and Beauty Shops	610	4,011	125	799	103	360	838	5,170
Broadcasting Studios	144	4,703	26	167	20	291	190	5,161
Clubs	245	4,745	49	508	73	1,179	367	6,432
Funeral Homes	643	5,910	140	1,140	87	608	870	7,658
Hospitals	359	6,106	95	939	73	491	527	7,536
Hotels	878	43,593	190	3,806	146	3,415	1,214	50,814
Office Buildings	748	89,200	224	16,144	215	8,024	1,187	113,368
Offices, Doctors and Dentists	1,150	3,656	530	1,818	309	2,515	1,989	7,989
Offices, Miscellaneous	8,086	53,370	3,177	10,045	4,753	14,774	16,016	78,189
Public Buildings	334	51,403	43	14,923	82	7,532	459	73,858
Recreational	419	2,989	68	1,220	71	1,310	558	5,519
Restaurants	4,375	71,758	1,102	13,463	1,106	11,097	6,583	96,318
Stores, Department	735	82,698	180	13,021	131	10,045	1,046	105,764
Stores, Drug	711	8,544	210	2,134	173	1,614	1,094	12,292
Stores, Retail Miscellaneous	4,675	74,754	1,064	12,245	1,182	11,710	6,921	98,709
Theatres	1,826	157,489	236	11,573	176	7,258	2,238	176,320
Other Commercial	2,261	40,200	806	7,809	1,641	13,196	4,708	61,205
Total Commercial	28,770	726,267	8,388	114,810	10,492	98,698	47,650	939,775
Industrial:								
Candy Manufacturing	183	10,008	26	310	15	369	224	10,687
Drug and Chemical Mfg.	82	5,263	21	317	20	493	123	6,073
Printing and Lithographing	57	3,433	13	305	17	134	87	3,872
Textile Manufacturing	48	2,236	20	1,334	33	963	101	4,533
Tobacco Manufacturing	27	1,512	6	68	3	81	36	1,661
Metal Working	10	947	17	1,251	57	3,556	84	5,754
Food Processing	265	7,290	38	858	42	461	345	8,609
Fur Storage	85	536	31	184	24	183	140	903
Other Industrial	1,686	63,681	798	8,963	1,135	22,593	3,619	95,237
Total Industrial	2,443	94,906	970	13,590	1,346	28,833	4,759	137,329
Total Unclassified	5,201	67,555	1,251	16,374	1,444	11,358	7,896	95,287
Total Installations	47,616	904,729	15,844	148,484	18,518	142,854	81,978	1,196,067

Table 2. The U. S. totals by detailed types of installations are shown in Table 1. All of these figures, from the Institute's annual report, are those reported by 150 utility companies covering approximately 58.5% of the total U. S. population as indicated in Table 3.

More air conditioning (horsepower) was installed in the East North Central region during 1941 than in any other, due to the large amount of industrial air conditioning installed in that region. Residential air conditioning (horsepower) installations in 1941 were greatest in the West North Central states while the largest volume of commercial air conditioning in 1941 was that in the South Atlantic states.

Total installations now on the reporting companies' lines (as measured in horsepower) are greatest in the Middle Atlantic states, which also lead in industrial and commercial air conditioning. The West

TABLE 2.—TOTAL REPORTED AIR CONDITIONING INSTALLATIONS BY REGION

Region	Prior to 1940		During 1940		During 1941		Total, Dec. 31, 1941	
	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.
New England								
Residential	276	274	77	39	28	20	381	333
Commercial	1,731	25,564	643	2,658	687	3,005	3,064	31,227
Industrial	121	3,255	24	371	30	309	172	3,935
Total	2,128	29,093	744	3,068	745	3,334	3,617	35,495
Middle Atlantic								
Residential	1,118	1,664	732	523	362	288	2,212	2,475
Commercial	7,504	221,266	2,372	29,511	2,051	23,845	11,927	275,622
Industrial	509	52,544	165	5,496	203	6,139	877	64,179
Total	9,131	275,474	3,269	35,530	2,616	30,272	15,016	342,276
South Atlantic								
Residential	619	1,158	258	240	571	486	1,448	1,884
Commercial	3,633	118,207	998	29,122	1,904	25,999	6,535	173,328
Industrial	835	5,960	596	2,485	828	1,739	2,259	10,184
Total	5,087	125,325	1,852	31,847	3,303	28,224	10,242	185,396
East North Central								
Residential	1,457	1,932	486	318	809	788	2,752	3,038
Commercial	6,219	129,538	1,993	17,832	3,221	16,654	11,433	164,024
Industrial	398	16,549	52	3,093	169	8,790	619	28,432
Unclassified	2,048	46,236	751	13,630	975	8,924	3,774	68,790
Total	10,122	194,255	3,282	34,873	5,174	35,156	18,578	264,284
East South Central								
Residential	117	275	52	52	228	168	397	495
Commercial	601	11,600	194	3,762	148	2,496	1,023	17,858
Industrial	43	765	16	392	30	2,582	89	3,739
Total	761	12,640	262	4,206	406	5,246	1,509	22,092
West North Central								
Residential	2,396	4,052	653	710	850	1,003	3,899	5,765
Commercial	4,486	87,945	1,050	13,726	1,074	10,796	6,610	112,467
Industrial	166	4,324	21	544	25	1,067	212	5,935
Total	7,048	96,321	1,724	14,980	1,949	12,866	10,721	124,167
West South Central								
Residential	2,232	5,013	890	1,148	518	723	3,640	6,884
Commercial	3,825	119,181	939	16,180	910	14,603	5,674	149,964
Industrial	152	2,224	65	570	30	2,724	247	5,518
Unclassified	191	3,994	3	70	2	238	196	4,302
Total	6,400	130,412	1,897	17,968	1,460	18,288	9,757	166,668
Mountain								
Residential	358	773	47	98	49	136	454	1,007
Commercial	234	7,869	61	1,282	51	266	346	9,417
Industrial	14	367	7	64	10	27	31	458
Total	606	9,009	115	1,444	110	429	831	10,882
Pacific								
Residential	2,629	860	2,040	582	1,821	353	6,490	1,795
Commercial	537	5,097	138	737	366	1,034	1,042	6,868
Industrial	205	8,918	24	575	21	5,456	250	14,949
Unclassified	2,962	17,325	497	2,674	467	2,196	3,925	22,195
Total	6,333	32,200	2,699	4,568	2,675	9,039	11,707	45,807

TABLE 3.—POPULATION SERVED BY UTILITIES REPORTING AIR CONDITIONING STATISTICS TO EDISON ELECTRIC INSTITUTE

Region	Population, in Thousands		No. of Reporting Companies	Per Cent of Population Covered by Reporting Companies
	Total, 1940	Served by Reporting Companies		
New England	8,437.2	4,196.1	16	49.6
Middle Atlantic ...	27,539.5	23,572.9	25	85.5
South Atlantic	17,823.2	9,819.6	22	55.1
East North Central.	26,626.3	17,767.7	30	66.6
East South Central.	10,778.2	2,112.7	7	19.6
West North Central	13,517.0	4,246.9	20	31.4
West South Central.	13,064.5	6,786.7	16	52.0
Mountain	4,150.1	659.4	5	15.9
Pacific	9,733.3	7,906.2	9	81.4
U. S. Total ...	131,669.3	77,068.1	150	58.5

North Central region, however, leads in residential air conditioning.

Of installations made in 1941, the largest subclassification (horsepower) in the commercial group was miscellaneous offices, followed by miscellaneous commercial with miscellaneous retail stores third. Of the total commercial installations on the companies' lines as of December 31, 1941, however, theaters led, followed by department stores with miscellaneous retail stores in third place.

Of industrial installations made in 1941 the largest group was in miscellaneous and unclassified industrial, with metal working second; textile air conditioning was third, followed by drug and chemical. Of the total installations now on the companies' lines the largest industrial classification is miscellaneous industrial, with candy manufacturing second, food industries third, and drug and chemical manufacturing fourth.

As measured on a horsepower basis, of all the installations now in operation in the United States, 28.5% are in Middle Atlantic states, 22.1% are in East North Central states and 15.5% are in South Atlantic states. The other regions, in order, are:

West So. Central, 13.92%; West No. Central, 10.39%; Pacific, 3.83%; New England, 2.97%; East South Central, 1.85%; Mountain, 0.91%.

Comfort Conditions in Rooms Influenced by Ionization

Recent investigations show that the state of ionization of the air of a room has an appreciable effect on the sensations of comfort experienced by the room's occupants.

Previously four main physical factors have been thought responsible for feelings of comfort, or the lack of comfort, these being temperature, humidity, air movement, and radiation of heat from walls and other solid objects in the room. The chemical composition, too, of the air in the room, meaning chiefly the concentrations of oxygen and carbon dioxide, has been known to be a factor, although this effect is now considered much less important than it once was. For instance, stuffiness in a room is no longer attributed forthwith to a lack of oxygen, as it once was apt to be, but rather to an upset in one of the four physical factors mentioned, and this latter, usually is found to be the real cause.

However, even when all these factors are observed and environmental conditions apparently are ideal, feelings of discomfort, headaches, and dullness often are experienced in crowded rooms. Thinking that the ionic state, or the electrical condition, of the atmosphere might have something to do with it, various investigators have made numerous tests, the results unfortunately being rather inconclusive until recently. This is now explained by the fact that too high concentrations of ions were used in the tests, these concentrations being higher than in the ordinary atmosphere.

Experiments were conducted in a theater and also in two experimental rooms. Temperature, humidity and air movement all were kept at levels such as ordinarily produced feelings of comfort. A concentric cylinder type of air ion counter was used to check ion concentrations, a simultaneous check being made upon both positive and negative light ions. Under conditions of low ion concentrations, headaches and similar symptoms of discomfort were recorded. These symptoms were prevented or overcome entirely by artificially building up the negative ion concentration to the value normally existing in clean fresh air, which is about 500 to 2000 negative ions per cubic centimeter. Higher concentrations of ions, however, seemed to have no further effect.

The exact mechanism by which the ion effects are brought about is not fully understood, but results are definite. They indicate that the concentrations of light ions in conditioned spaces should be given important consideration along with the other physical factors of temperature, humidity, and air movement.

Attu Has Cold Climate

Attu Island, nearest spot to Asia under the American flag, was only a name on the map until recently. Today it has become a vital spot in the defense of the North American continent.

The present climatic conditions on Attu are rather rigorous, the average summer temperature being only about 50F, with a maximum of 66F. The winter temperatures, however, are not excessively low, the average being about 12F. It is one of the rainiest spots on earth and has a yearly relative humidity averaging about 90%. The mountains are enveloped in almost perpetual fog. There may be 250 rainy days a year and as few as 8 wholly clear days.

FUEL SITUATION

OBI Supports Rationing Formula; Domestic Conversions Still Lagging; ASHVE Holds Fuel Problem Forum.

The threatened fuel oil shortage on the Eastern Seaboard continued during August to occupy the attention of heating men, governmental agencies, home owners and apartment house operators. As HEATING AND VENTILATING goes to press, no definite word has been given as to exactly what oil rationing plan, if any, will be adopted. The whole problem became more acute as the heating season began in upper Maine.

OBI Plan

Oil Burner Institute, trade association of oil heating equipment manufacturers, has proposed that the indicated fuel oil shortage on the East Coast be met with a plan for equitable distribution of fuel oil—as opposed to an arbitrary percentage cut—and has submitted such a plan for government consideration.

C. E. Lewis, OBI president, presented the viewpoint of OBI's engineering committee in the following abstract from a letter addressed to Donald M. Nelson, WPB Chairman; Harold Ickes, Petroleum Coordinator; and Joel Dean, Fuel Rationing Chief of OPA:

"A method of distributing oil equitably should be based on minimum requirements after consideration of the following factors:

"1. Oil consumed in terms of the size of the house. A formula for oil consumption in terms of livable floor area has been proposed by R. K. Thulman, of the Federal Housing Administration, which seems reasonable.
"2. Oil consumption in terms of the number of occupants of the house, as a limit.
"3. Restrictions to insure that oil usage will be no greater and probably less than past usage, as a limit.
"4. Relative ease and cost of conversion.
"5. An adjustment of oil allowed to actual degree days.
"6. Consideration of special requirements of invalids, elderly people, etc."

The Institute's engineering committee developing the plan is composed of engineers from leading oil heating equipment manufacturers. The committee includes: F. H. Faust, General Electric Company, chairman; William Bulger, Petroleum Heat & Power Co.; J. C. Hauff, Jr., May Oil Burner Corp.; H. C. Jones, Delco Appliance Division, General Motors; J. A. Logan, Gilbert & Barker Mfg. Co.; D. J. Luty, Gar Wood Industries, Inc.; and Milton Powers, Timken Silent Automatic Division, Timken-Detroit Axle Co.

Mr. Thulman's Formula

The plan proposed by R. K. Thulman, chief mechanical engineer of FHA, is reported to be as follows:

Normal fuel requirements of an average house can be approximated by the formula

$$G_n = \frac{20AD}{EH}$$

where

G_n = gallons of fuel oil per normal season,
A = square feet of occupied and finished floor area,
D = normal number of degree days per season,
E = efficiency of utilization, and
H = heat content of fuel, Btu per gal.

When E = 70% and H = 140,000,

$$G_n = \frac{AD}{5000} \text{ (Approx.)}$$

If the constant 5000 is increased to 6000, and if the ceiling is moderately insulated and the burner placed in good operating condition, then the formula would provide for a cut of about 25% in oil required; so that

$$G_R = \frac{AD}{6000} \quad \ldots\ldots\ldots (1)$$

where G = the rationed gallonage, is proposed as one formula. (The constant, it is presumed, would be adjusted on the basis of the severity of rationing.) However, to prevent the exceptional user from obtaining more oil than normal, a second formula is proposed:

$$G_R = .9G_n \quad \ldots\ldots\ldots (2)$$

where the constant is also liable to change. To provide against the case where too much oil is burned per capita (too large a house), a third formula is suggested:

$$G_R = \frac{PD}{8} \quad \ldots\ldots\ldots (3)$$

where P = number of persons living in the house. Here again the constant finally selected may be some other value.

The fuel would be calculated by the three formulas (1), (2), and (3), and the house receive the oil indicated in the formula giving the smallest quantity.

As an example, assume a house with 2500 sq ft of floor area in Boston occupied by three people and normally burning 3400 gal per season. Boston has a normal degree-day total of 6045.

By (1)

$$G_R = \frac{2500 \times 6045}{6000} = 2520 \text{ gal.}$$

By (2)

$$G_R = .9 \times 3400 = 3060 \text{ gal.}$$

By (3)

$$G_R = \frac{3 \times 6045}{8} = 2260 \text{ gal.}$$

Since (3) is the smallest, the house would receive 2260 gal. The house is too large for the number of occupants. If this same house were occupied by a five-person family, (3) would give 3780 gal, so that (1) would be the smallest, and the 5 person family would receive 2520 gal.

Committee Plan

As HEATING AND VENTILATING goes to press, it is reported that the plan of OBI's engineering committee, under consideration by Washington early in September, involves the issuing to all users of a basic or A ration of 60% of normal requirements to which would be added additional allowances as follows: full-weatherstripping, 6%; all storm windows, 8%; attic insulation, 10%; burner and plant in good condition, 6%. Thus if an owner reported to the ration board that he had all these, he could obtain 90% of his normal gallonage. If this was unsatisfactory to the consumer, the plan would provide that he apply for a B ration which would involve application of an engineering formula somewhat as described above.

Rationing Zones

According to preliminary reports, the area to be rationed will be divided into four zones, roughly as follows: one, the New England States and upper New York State; two, Southern New York and the States of New Jersey, Pennsylvania, Delaware and Maryland, including the District of Columbia; three, the

stretch from Virginia along the coast to Charleston, S. C., and four, the area along the coast from Charleston to the southern tip of Florida. In each of the areas, ration allowances will be based upon the number of degree-days prevailing in each.

The program, it is stated, contemplates a ration book in which stamps, to be collected by the fuel delivery man, will call for varying quantities and will be divided to coincide with the expected weather changes. Provision for a reserve allowance to tide consumers over unexpected cold snaps or to provide ample heat in case of illness in a home have been included in the program.

It was also reported that the plan provides for a set of coupons good for the months of September, October and November, a second lot which would be good for the month of December, a third for January and a fourth for February. The last group of coupons in each book will cover the needs for March, April and May.

How large a reserve allotment will be allowed remains to be determined.

Industrial Plants Converting

East Coast industrial plants have far outdistanced the domestic consumer in taking precautions against the fuel and heating oil shortage, according to a report from the petroleum industry today to OPC. John A. Brown, Chairman of the Petroleum Industry General Committee for the East Coast area, reported that the program for converting Atlantic Seaboard industrial plants from fuel oil to coal consumption is making excellent progress, but that neither industrial nor domestic consumers fully comprehend yet the gravity of the fuel oil situation. Mr. Brown said that East Coast industrial plants already had converted from fuel oil to coal in more than 50% of the cases where conversion is possible, and, as a result, were saving more than 22,500,000 barrels of fuel oil annually.

As contrasted with the progress being made in industrial plants, Mr. Brown reported that not more than 1% of homes now heated with fuel oil have been converted.

According to *Fuel Oil & Oil Heat*, authoritative organ of the oil-burner industry, domestic conversions range from none in many cities to a high of 3% in a Boston suburb, with an average of 0.68% as of August 1. That publication also reports coal plentiful in 15 Eastern cities, scarce in 11.

ASHVE Sponsors Meeting

War on Fuel Waste Week was officially opened August 17 at the Hotel Pennsylvania, New York, by a forum on fuel conservation sponsored by the War Service Committee of the American Society of Heating and Ventilating Engineers, with W. L. Fleisher presiding as chairman. M. F. Blankin, Philadelphia, first vice-president of the ASHVE, was toastmaster at the luncheon which followed.

At the luncheon Mayor Fiorello H. LaGuardia of New York proposed that the Society study the problem of the small home owner who had a difficult heating or fuel conservation problem and urged the establishment of a consulting panel where competent advice could be obtained at low cost so as to protect the owner against racketeering which might flourish during the emergency.

Speakers at the forum were Dr. C.-E. A. Winslow, Professor of Public Health, Yale University; Ned Foulds, Chief of the Fuel Oil Section, Petroleum Coordinator's Office; Dr. Luther Harr, Bituminous Coal Consumer's Counsel; and W. Walter Timmis, Chief of the Plumbing and Heating Branch of the War Production Board.

Mr. Timmis warned that conversion of oil heating plants must be made immediately if home owners are to obtain the necessary vital materials used in such conversions. He pointed out that the fuel problem must be approached from both the conversion plan and the installation of storm sash and other types of insulation.

Four methods of fuel conservation were outlined by Dr. Harr, who stated that the bituminous coal industry "has moved 27,000,000 tons of coal over normal" to meet the winter emergency.

Dr. Winslow urged that home owners in the areas affected by the shortage reduce normal winter interior temperatures and wear warmer clothing while indoors. Dr. Winslow explained that tests have proved that all but infants and the aged are physically able to stand indoor temperatures of 10F less than are normally maintained.

Heating Season Begins in N.E.

The fuel situation emergency has already begun in New England, for the heating season has begun in Maine. At the Governors' Conference in Augusta, Me., held by the governors of the six New England states to consider the fuel oil crisis and other matters, June Richdale, fuel administrator for Massachusetts, told the assemblage that the deficit of fuel oil for New England to date was 55,279 tank-car loads. The actual number needed each day to supply both industrial and household needs is set at 1250, and it will take an increase of 457 cars daily from Aug. 13 to Dec. 1 to overcome the deficiency, according to Mr. Richdale. He also said that the total of tank-cars to be allotted to eastern oil traffic will be shortly increased from 62,000 now in use by 5000 additional, not all of which will be allotted to New England, however. Icebound terminals, such as Lake Champlain and the Connecticut, Kennebec and Penobscot rivers will be served first for storage supplies.

New England's first all tank-car train of fuel oil rolled into the Providence yards of the New Haven railroad August 17, bringing almost 600,000 gallons of various types of petroleum in a line almost a third of a mile long. The train came from Port Arthur, Texas, and was 4½ days on the run, a record-breaking trip and the first, it was hoped, of many to fill empty New England fuel tanks. It was a test of the plan of sending 60 cars in one through train 2500 miles, over various railroads with stops only for car inspection and switching to the different lines. Rapid unloading was expected to cut the "turnaround" time from 19 to 12 days.

Gas Heat Restricted

Delivery of manufactured gas to new industrial and domestic consumers was restricted by WPB August 25 in order L-174 designed to cope with gas shortages expected this winter. The order is a companion to L-31 affecting natural and mixed gas issued last winter.

After September 1, 1942, no gas may be delivered to a non-residential consumer for the operation of any gas-fired equipment which was not operated either by the consumer or on the same premises prior to that date, unless (a) the capacity of the new equipment is less than 150 cubic feet per hour, or (b) the new equipment replaces existing gas-fuel equipment of the same or greater capacity, or (c) the director-general for operations of WPB grants approval for the delivery of gas for the new equipment.

Extent of Shortage

Ralph K. Davis, deputy petroleum coordinator, told New England officials that only 75% of normal fuel oil requirements would be available in New England this winter under the best conditions. On the other hand, R. L. Minckler, director of petroleum supply of OPA, said that the available supply of fuel oil would meet 90% of normal requirements if this winter is as mild as last winter. He indicated that it appeared that no more than 85% of normal requirements would be available in the mid-west.

Theory Vs. Practice

Piping Improvements

By T. W. REYNOLDS

THE writer has seen many a job where improper piping conditions have been corrected at considerable expense, or where radiators have been increased in size or new radiators added when the limited money on hand might better have been spent on a new boiler of proper size, for it is surprising to find in trouble work that many a piping condition not in accord with Hoyle, many a luke warm radiator, and many an ice box room, will give entire satisfaction or nearly so when backed up by the proper boiler, burner and chimney.

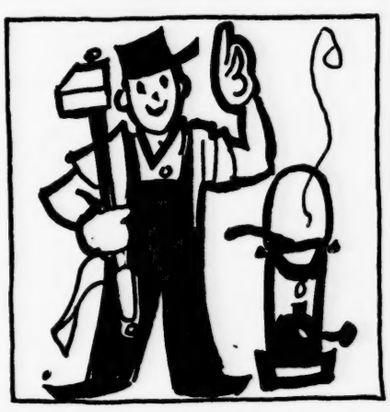
How the pipes in a heating system are originally run will depend to some extent upon the arrangement of the cellar; just what changes are required to make these pipes function satisfactorily will depend upon how well supported they are, by the proper size of equipment. If, by way of example, they are backed up by a power house, as with a change-over to street steam, but little if anything need be done other than the change-over. The old heating systems in the brownstone fronts of New York City are notoriously inefficient and unsatisfactory, yet usually prove satisfactory once the boiler is replaced by street steam at higher pressures and unlimited capacities. On the other hand, in low pressure insulations there are limits beyond which one cannot go in piping the job. Pipes cannot be run as an electrician would run wire, which brings to mind the chant, "Pipes here, pipes there, get no steam anywhere," as well as the old saying that the steam mains are "overhead."

A troublesome piping job due to undersize mains of considerable length can often be cheaply altered by running a separate branch main to all radiators near the boiler, so as to reduce the load on the old mains. This is of special benefit where the radiators served by the new branch main were formerly connected near the end of the old main.

Mains run midway the length of a building in reality produce no saving in first cost of installation due to the labor involved in extending long runouts from main to side walls, yet such arrangements are a common sight. Several circuits balanced for length and load, in so far as practical, serve to provide more venting points and to distribute the steam to all points at about the same time. Returns are of lesser importance and may be run at the ceiling or near the floor, but in any event must be maintained either well below or else well above the boiler water line. The use of returns can be avoided altogether where the main can be run so as to terminate at the boiler.

When the radiation is under capacity requirements, it is more apt to be so on the second or top floor than anywhere else, due either to no allowance having been made for roof exposure when sizing the radiators or to insufficient allowance for the conditions, which become worse as the roof ages. Unfortunately, radiator changes on an upper floor may require piping alterations of a more expensive nature, as large radiators may require larger valves and runouts, or the dimensions of the new radiators may be such that floor boards have to be taken up for access to the runouts. Possibly new risers may also be required; however, if run exposed they are easy to install and help to make up any deficiency in radiation of the lower rooms.

Runouts in one pipe systems of 1 in. size from mains to risers and from mains or risers to large radiators should be increased to 1¼ in., particularly those on the first floor, as these can easily be repiped from basement mains; but risers of only 1 in. in size may prove satisfactory since water and steam can counterflow in a vertical pipe with much less difficulty than in a horizontal pipe. It may appear inconsistent to run a 1¼ in. supply from a main to a 1 in. riser which in turn supplies a radiator runout of greater size, but it is nevertheless correct. In like manner, the branch fittings in mains and risers, which should preferably be increased from 1 in. to 1¼ in. outlet, may be retained with 1 in. outlets because an outlet does not offer the same restriction to flow that a horizontal pipe does. This avoids the expense of taking down the mains or risers, with re-installation of same and starting at leaks elsewhere.



Sun porches are usually located over an open or unexcavated space out beyond a thick cellar wall, all of which presents a problem as to how any new radiators may be connected up. In such cases it is better to remove the existing radiator and install one of the larger size connected to existing branches rather than to add a new radiator with new branches difficult to run.

WASHINGTON NEWS

summarized by Loring F. Overman. Materials Distribution to be Changed; Fuel Conservation Measures Cataloged; First Half Construction $6,000,000,000

Disturbances in the materials situation assumed major importance during the past month. They began with close-downs of many war plants due to shortages of raw materials. A series of moves later developed in which Donald Nelson fought for control of materials by WPB using authority granted him by the President to take away priority powers from the Army and Navy.

The situation in materials was due not so much to overall shortages as to a faulty flow of distribution. In the early stages of the war program production was the Number 1 job and the materials problem was set aside for later attention.

The program is now in the balancing period in which production schedules are being adjusted. Sights were set high in the original scheduling. As a result some of them have to be lowered now. This was better, Donald Nelson declares, than figuring it all out beforehand, delaying the plant building program in the meantime.

"There are two ways that you can schedule production," says the chief of WPB. "There is one way, to set goals that you are reasonably sure you can reach and then depend upon beating them. There is another method of scheduling, and that is to set a goal so high that it is going to be almost impossible to reach it, and that is the kind of schedule that I believe in setting."

Another factor contributing to present shortages experienced by war plants is that the main idea at the start was to get production going in every direction at once. As a result, some plants are now ahead of others manufacturing component parts so that shell production may run ahead of ability to load them.

Adjustment of scheduling now consists of re-rating of all projects according to their urgency. Army and Navy must submit the list of items they require according to their urgency. Under the previous priority system products were rated according to their importance, not always according to their urgency.

PRP Overhauled

In line with this program PRP has been overhauled, putting into effect controls which have been developed during the last eight months.

Basic changes in the present PRP plan will apply to fourth quarter applications. Nearly 30,000 manufacturers were brought under PRP for the third quarter but applications were not received in time for an analysis of overall requirements.

The fourth quarter materials control system will tend to counteract any inflation of preference ratings by restricting the amounts of materials authorized for the various essential military and non-military purposes, *regardless of the ratings which have been assigned.* This means, that in many instances, allocations of a proportionate amount of previous requirements under M orders will be reduced under the amount stipulated.

New ratings may be used to expedite deliveries but they will not increase the quantities which any company is authorized to receive. Increases in the quantity authorized may be obtained by submitting applications on the interim form PD-25F.

Under the new PRP system one copy of each application is sent to the Bureau of the Census where the indicated total materials requirements will be tabulated in terms of over 200 end product classifications. Another copy is sent to the branch of WPB responsible for processing it, where a tabulation of materials requirements of all industries and companies assigned to that branch will be made.

Both the Bureau of the Census and the various industry branch tabulations will be submitted to the Requirements Committee, together with reports on prospective supplies for the quarter from the Materials branches. J. S. Knowlson is chairman of the committee and also WPB chairman on Program Determination.

After examination of the figures, Mr. Knowlson will determine the general pattern of materials distribution, both in terms of the 223 end products and in accordance with the companies assigned to the various branches. These determinations will then go to the various branches. Individual applications will be processed according to the amounts of materials which may be authorized for each end product. The branches will be under rigid instructions to give the same treatment to similar cases. However, the inventory position of each applicant and the pattern of preference ratings on the orders he will fill during the quarter will be given full consideration.

Secret Directives

In recent weeks WPB has issued several secret directives in connection with the PRP plan. The reason they have not been made public information is that in each instance ratings are assigned which might draw protests from other industries competing for the same materials. One of these directives was recently issued giving manufacturers of boilers, furnaces, heating stoves, repair parts and grate equipment ratings up to A-1-A for 85% of their anticipated requirements. All material allocations, under the directive, are made subject to Orders L-22, L-23-c, and L-42 by which they are covered.

May Release Controls Material

Developments in the program to secure allocations of materials under PRP for the manufacture of temperature controls indicate the probability that release of metals will be handled under one of these unpublicized processing directives. This directive is regarded by WPB officials as not far off.

At a meeting of control manufacturers with the Plumbing and Heating Branch in August to discuss the fuel conservation program a list of 21 methods of reducing heat loss without cost were submitted. Methods were suggested both for commercial and domestic users. Although all these expedients are generally known to the heating industry it was the first time they had been so completely catalogued, according to WPB officials. The suggestions will be publicized in the forthcoming conservation drive now in preparation by the Government agencies.

Manufacturers were requested at the meeting to submit immediately upon their return home estimates upon the amount of fuel savings to be made in relation to the amount of materials required for heat control instruments. These letters came into WPB almost immediately and action upon material allocations for controls is expected in the near future. It is pointed out that allocations of metal for controls will probably not

be as large as indicated because in many instances manufacturers have large inventories of parts or of component metals. Allocation of metals for controls will be largely a matter of balancing inventories, it is pointed out.

Conversion Program

New factor in the oil burner conversion program is that it is now believed great numbers of domestic users are purchasing grates but not installing them. WPB officials urge that the heating industry inform these people that they may not be able to secure mechanics to install their grates if they delay too long in the hope Uncle Sam may rescue them at the last minute from a fuel oil shortage. Government experts working on the conversion program estimate that a labor shortage affecting oil burner conversion will occur about October 15.

Although industrial conversion is progressing satisfactorily domestic changeovers are still disappointing. It is estimated that the number of domestic conversions is somewhere between 20,000 and 60,000.

Because of the poor response to this program, Deputy Petroleum Coordinator for War Ralph K. Davies recently indicated that an order might soon be issued which would prohibit the sale of fuel oil to consumers whose heating plants can be converted to coal.

Issuance of this order will depend upon how much fuel oil is available the first of the year and upon January temperatures, according to WPB officials.

Fuel Oil Rationing

Plans to ration fuel oil in the east coast area were under study by a special committee appointed by Donald Nelson August 21. The committee, which was given full power to act, was named in accordance with recommendations of the War Production Board meeting August 18.

Members of the rationing study committee are Under-Secretary of War Robert P. Patterson, Secretary of the Interior Harold Ickes, and Price Administrator Leon Henderson.

Program of the committee was to determine first of all whether use of fuel oil on the eastern seaboard should be curtailed this winter, and secondly, what type of rationing should be used.

Discussion of rationing of fuel oil has been under way for several weeks by a committee of experts from various branches of the Government, including the Office of the Petroleum Coordinator, OPA, and the Plumbing and Heating Branch of WPB.

"Cognizance will be taken of the fact that winters vary and degree-days vary in different sections of the country," one member of the committee declared.

Eastern states will have only 75% of the fuel oil for heating purposes they had last year under the contemplated rationing program, according to a recent statement of Deputy Coordinator Davies.

Governors of states in the affected area have joined the drive to stimulate conversions of home oil-burners to the use of coal. State programs enlisting the cooperation of fuel dealers in getting the facts of the "convert — conserve — and avoid a cold home" program across to all their customers is also part of state executive efforts to help beat the fuel oil shortage.

An extension of the Plantation Pipe Line from Greensboro, North Carolina, to near Richmond, Virginia, was approved by the Office of the Petroleum Coordinator for War on August 22. This move will make 30,000 barrels of oil products available daily at Richmond. Diversion of oil tankers to the East coast area from the Southwest was also designed to increase fuel oil supplies in the affected area.

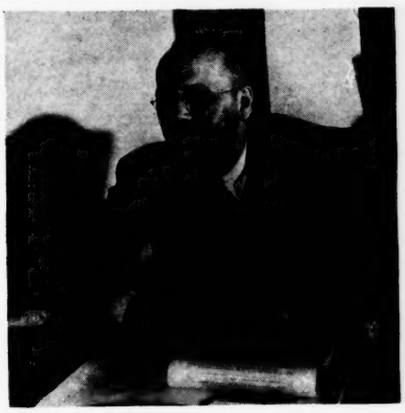
Grates

Home owners and plant operators were urged to make immediate arrangements to obtain grates and stokers needed to convert fuel oil-burners, and at the same time, to purchase the necessary amounts of coal, in a recent statement issued by the Plumbing and Heating Branch.

The Branch pointed out that the action of WPB in setting aside 11,000 tons of material needed for conversion will have served its purpose only if manufacturers receive the orders on which to base their application for allocation of materials.

Home owners were informed that they may be able to find the type of grates they need by going to a heating contractor or distributor.

Industrial plants desiring to obtain stokers were urged to file an application for a preference rating with the Plumbing and Heating Branch on Form PD-25-f, if they are under the PRP plan, or on Form PD-1-a if they are not.



H. M. Brundage, appointed deputy regional director of WPB in New York. Mr. Brundage joined OPM in 1941, since then has been with the plumbing and heating branch of WPB in Washington. At one time he was sales manager, Washington Gas & Light Co., later had his own business in Richmond and Norfolk.

Copper Exemptions

Added to the list of items that may be manufactured of copper for the armed services of the United States are air conditioning equipment, certain plumbing and heating supplies, and unit heaters and heater parts. This revision of the Copper Conservation Order M-9-c permits manufacture for the purpose specified until Sept. 1, 1942, pending further discussion of the status of the items added to the list.

Construction Figures

Total private and public construction for the first half of 1942 in the continental United States amounted to more than $6 billion, Secretary of Labor Frances Perkins recently reported.

Under the expanded war program public construction rose from approximately $2.4 billion in the first six months of 1941 to $4 billion during the first half of 1942, according to the report.

Federal financed war housing expenditures in the first six months of the year amounted to $226 million. Public non-residential activity declined to about 75% of the total for the first half of 1941.

Employment on war construction projects reached one million persons or nearly one-half of the employment in the construction industry in June, 1942.

Further curtailment on non-war construction will cause a rapid decline in employment in the third and fourth quarters of 1942, and will reduce the annual average employment on non-war projects to one-half of the annual level for the preceding two years, the report estimates.

Allwork In New Appointment

Appointment of Ronald Allwork, New York City, as deputy chief of the Plumbing and Heating Branch was announced recently by W. Walter Timmis, chief of the Branch. Mr. Allwork has been chief of the Planning and Projects Section of the Branch since February of this year. The duties of the Planning and Projects Section will be consolidated under Arthur L. Rayhawk, of Pueblo, Colo., who has been research advisor to the Branch.

REVIEWS of TECHNICAL publications

POSTWAR PLANNING

"Postwar Planning for the Construction Industry." Published by The Producers' Council, Inc., 815-15th St., N.W., Washington, D.C. Single copies free when requested on business letterhead.

The need for postwar planning in order to anticipate the many problems which will confront business upon the cessation of hostilities is being realized with increasing clearness even as the nation is just approaching its full stride in war production and the business of winning the war. This need was realized at an early date by the construction industry, which appears to be singled out for a major responsibility and a major opportunity following the war.

Through Committees appointed at a Detroit meeting shortly after Pearl Harbor the problem has been approached from five different directions, as follows: (1) Technical—Consideration of developments in construction techniques, materials and equipment and to building codes and standards of construction. (2) Building Finance—Providing adequate financing for industrial, commercial, or residential construction and reconstruction (including consideration of taxation). (3) Industry and Consumers' Relations—Promotion of markets, maintaining of construction's share of the consumer's dollar, development of sound public relations. (4) Distribution — Development of means for making construction more readily purchasable through efficient and economical flow of goods from manufacturer to completed construction facilities. (5) Government Relations to Construction — Analysis of ways and means in which the Government can facilitate and motivate private construction.

This 26-page, 8½ by 11 in., paper covered, booklet outlines the results of the work of these committees.

FURNACES AND COMBUSTION

"Industrial Furnaces, Volume II," by W. Trinks. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price, $5.00.

The second edition of this comprehensive and authoritative work follows the general plan and scope employed in the original edition which gained such widespread recognition both in this country and abroad. Some passages, however, have been entirely rewritten due to a deepening in theory and improvement in equipment applications which have occurred since the time of the original publication.

The author, who is Professor of the Mechanical Engineering Department of Carnegie Institute of Technology, continues to devote Volume II almost entirely to equipment, leaving Volume I to take care of the main considerations of design. Accordingly, this volume is intended chiefly for men who are responsible for the selection and operation of furnace equipment as well as for sales engineers.

The book has 1267 pages, size 6 by 9 inches, bound in cloth. It is divided into six main parts, the chapter on comparisons of fuels and of furnace types being especially outstanding. Other chapter headings are as follows: Fuels and Sources of Heat Energy; Combustion Devices and Heating Elements; Control of Furnace Temperature; Control of Furnace Atmosphere; and Labor-Saving Appliances.

BUILDING EQUIPMENT MAINTENANCE

"200 Ways to Reduce Engineering and Maintenance Costs in Hotels, Hospitals, Apartments and Institutions." Published by The Dahls, Stamford, Conn. Price, $1.00.

In recognition of the urgent need for nationwide conservation of power, critical materials, and labor, this useful, 144-page, pocket-size booklet has been prepared. In it are discussed the many phases of the proper upkeep and operation of mechanical equipment in the types of buildings mentioned. Each of the authors has contributed to those branches for which long experience has qualified him.

Some of the chapter headings included in the contents are as follows: 30 Ways to Reduce Air Conditioning Costs; 30 Ways to Reduce Refrigeration Costs; Tested Ways to Control Cost of Electricity; 50 Ways to Conserve Equipment and Materials; and, Fuel, Steam and Water Control.

VENTILATION

"Safe Practice in Photolithography as Used in the Manufacture of Bottle Caps. Safe Practice Bulletin No. 94." By J. A. Cummings, Armstrong Cork Co. Published by Department of Labor and Industry, Commonwealth of Pennsylvania, Harrisburg, Pa.

A nine page, 8 x 10½ inch mimeographed bulletin giving an outline of various processes used in photolithography, with special reference to the hazards involved and to the methods used in safeguarding workmen against them. Proper air conditioning and ventilation are cited as two of the principal instruments for this purpose.

WELDING

"Procedure Handbook of Arc Welding Design and Practice." Published by the Lincoln Electric Company, Cleveland, Ohio. Price, $1.50.

As a result of the generous reception accorded the previous editions of this book, originally published in 1933, a seventh edition enlarged and revised has just appeared. This is due, in considerable measure, to the very large part being played by welding in the nation's war effort, and to the need for an authoritative work which will facilitate the training of new men needed by expanding war industries.

The authors of the book have made every effort to provide as much complete and up-to-date information as possible to help the men in the shops, shipyards, airplane factories, ordnance plants and arsenals produce to the fullest extent.

New and significant information is given in the new handbook on such subjects as welding symbols, new allowable stresses, pre-heating for welding, stress relieving, procedures, speeds and costs.

The book's eight sections covering various phases of Welding are as follows: Part I, Welding Methods and Equipment; Part II, Technique of Welding; Part III, Procedures, Speeds and Costs; Part IV, Weld Metal and Methods of Testing; Part V, Weldability of Metals; Part VI, Welded Steel Construction—Machine Design; Part VII, Designing of Arc Welded Structures; and Part VIII, Typical Applications of Arc Welding in Manufacturing, Construction and Maintenance.

Book has fabricoid cover, 1,308 pages, 1,810 illustrations and is 6 by 9 inches.

EQUIPMENT UPKEEP

"Civilian Conservation of the B.T.U." Published by Carrier Corp., South Geddes St., Syracuse, N. Y.

A shortage of experienced field service and maintenance engineers has already made itself felt in the air conditioning, refrigerating, and heating fields as a result of many men being called into the armed forces or moving to other industries. Consequently, the problem of maintaining such equipment in good operating condition is becoming rather acute.

This new 24-page, 5 x 8 in., reference manual is intended to serve as at least a partial answer to this situation. Much of the work normally performed by experienced servicemen could very well be done by the average equipment owner if he had a reasonable amount of information about his equipment. It is expected that this book will supply such information.

Among the subjects which are covered in simple language are: air infiltration, bearings, belts, coils, compressors, condensers, controls, couplings, dampers, ducts, expansion valves, fans, filters, and flywheels; also gauges, humidifiers, leaks, metals, motors, refrigerant, refrigerated boxes and cold storage rooms, screens for air intakes and spray nozzles.

CONVERTING TO COAL

"Suggestions for Conversion from Oil to Coal." Report No. 3121. Published by Anthracite Industries Laboratory, Primos, Delaware County, Pennsylvania.

In response to numerous requests for information as to the proper method of converting oil-fired equipment to coal and of conserving fuel, this bulletin has been prepared. It is intended to offer simple non-technical answers and suggestions to such inquiries. It shows what points should be checked in the examination of a heating plant to determine the feasibility of conversion and gives helpful suggestions as to the best way to procure missing parts such as grates, doors, and the like.

Discussed also are advantages of using supplementary fireplace heating and the use of auxiliary coal-burning equipment used in parallel with existing non-convertible oil-fired hot water heating equipment. Thermostatic control and methods for retaining as much as possible of the oil burner automatic controls are also outlined.

The report is paper covered, 8½ by 11 inches, 8 mimeographed pages.

FURNACE STANDARDS

"Proposed Commercial Standard for Warm Air Furnaces with Vaporizing Pot-Type Oil Burners." U.S. Department of Commerce, National Bureau of Standards, Washington, D.C.

This mimeographed standard TS-3303 was adopted by the manufacturers conference June 24, 1942. It is intended to serve as a basis for certification of the quality and performance of warm air furnaces equipped with vaporizing pot-type oil burners and arranged with either gravity or forced air circulation. Floor furnaces are not included. The standard is for the guidance of manufacturers, distributors, installers, contractors and purchasers.

It is divided into the following sections: General Requirements; Furnace Design and Construction; Performance; Test Code for Forced Air Furnaces; Test Code for Gravity Furnaces; Publication of Furnace Ratings; Informative Labeling; Guarantees; and Effective Date.

OIL BURNER STANDARDS

"Automatic Mechanical-Draft Oil Burners Designed for Domestic Installations. Commercial Standard CS75-42." Superintendent of Documents, Washington, D. C. Price, 10 cents.

This 26-page, 6 x 9 inch pamphlet issued by the National Bureau of Standards, U. S. Department of Commerce, reports the standard specifications accepted by the Trade as its standard of practice for new production beginning July 20, 1942.

Listed are general requirements applying to burner construction and performance, manufacturing and production tests, safety standards, combustion performance, radio interference, and others.

NEWS OF THE MONTH

Carnegie Will Study Corrosion

NEW YORK—Dr. J. C. Warner, head of the Department of Chemistry at Carnegie Institute of Technology, Pittsburgh, and F. C. McIntosh, chairman of the committee on research of the ASHVE, announce the consummation of a cooperative agreement to investigate one of the causes of rust in steam pipes and equipment. The particular phase of the problem to be studied is the process by which carbon dioxide, entering with the steam, becomes dissolved in the condensate.

The research work will be carried on in the Institute's chemical laboratory in an apparatus especially designed to represent types of equipment in actual service. D. S. McKinney, assistant professor of chemistry at Carnegie Tech, will supervise the work which will be done by John J. McGovern, a graduate student. The test should give information that will help improve engineering and trade practices in rust prevention and thus reduce the number of replacements made necessary by corrosion.

This program of research was outlined by the ASHVE research technical advisory committee on corrosion of which Leo F. Collins, Detroit, Mich., is the chairman. Other members of the committee are H. E. Adams, N. D. Adams, J. F. Barkley, W. H. Driscoll, T. J. Finnegan, W. Z. Friend, E. W. Guernsey, W. E. Heibel, A. R. Mumford, R. R. Seeber, E. T. Selig, Jr., F. N. Speller and C. M. Sterne.

OBI May Change Its Name, Scope

NEW YORK—The Emergency Committee for the Oil Burner Industry closed its office at 71 Vanderbilt Ave., New York, at the end of August and Robert A. Richardson, special representative of the Committee, was transferred to OBI headquarters, where he will continue as a member of the OBI headquarters' staff.

OBI will enlarge its scope of activities and change its name to Oil-Heat Institute of America. Members will be asked to approve this change at the semi-annual meeting in New York on October 13. The expanded OBI will include in its membership oil burner manufacturers (domestic and industrial equipment), national or regional fuel oil marketers, incorporated dealer groups, accessory manufacturers and honorary members. The structure of the Board will provide for representation of all groups.

May Ban Cost-Plus Contracts

WASHINGTON — As a result chiefly of the difficulty involved in renegotiating cost-plus-fixed-fee contracts which were substituted for the pre-war tender system to speed up war production, it is reported that the Army, Navy and Maritime Commission now plan to replace these in turn by fixed-price contracts which might be described paradoxically as "negotiated bids." Army and Navy price adjustment boards by renegotiation have deleted $557,000,000 of excess profits from war contracts already completed by the end of June, and hope to save some billions more before the war is over.

To renegotiate cost-plus-fixed-fee contracts for the purpose of lowering costs it has been found necessary to check nearly every item which entered into them. The time-wasting character of this procedure is one of the chief reasons why a change-over is to be made as quickly as possible to fixed-price contracts, it was explained.

In a joint statement setting forth policies and procedures for renegotiation, the price adjustment boards for the Army, Navy and Maritime Commission allowed it to be inferred that they did not believe the flat profit limitation proposed for war contracts in some Congressional circles would be practicable. They made it obvious that they were guided by the following principles:

Reasonable profits should be allowed to encourage maximum war production at low cost.

No fixed formula for determining reasonable profit is contemplated, since an attempt to apply it to all types of war manufacture would produce inequities.

Prepares for Post-War Building

NEW YORK — An appropriation of $10,331,555 for the preparation of plans and specifications for schools, hospitals, subway extensions, parks, bridges and various other construction projects to be undertaken after the war was voted August 20 by the City Board of Estimate.

Estimated total cost of the projects to be covered by these plans is $312,603,000. In addition, funds previously were made available for planning other postwar projects to cost an estimated total of $81,417,000. In all, therefore, funds are now available for planning $394,020,000 worth of postwar construction, intended to cushion an expected wave of unemployment.

-80F D.B. for Plane Test Lab

SAN DIEGO—An alti-chamber laboratory designed to simulate rarefied atmosphere and extreme cold temperatures found up to 70,000 feet, or nearly 13 miles, is under construction at the Consolidated Aircraft Corporation's plant here, and was reported as placed in operation about mid-August.

Equipment was designed by and is being installed under the direction of Dr. H. M. Helmholz, Jr., formerly associated with the Mayo Foundation. The equipment is designed to study problems of flight in the stratosphere, and to ascertain effects of cold and thin air on bomber equipment and personnel.

Crews will be prepared for high altitude flights in a huge decompression chamber, temperatures inside which will reach a maximum of 80F below zero, said to be 20F colder than any decompression chamber now in use. The alti-chamber will accommodate 12 men at one time. On a flight they will wear heated flying suits and oxygen masks. Men inside the chamber will be able to communicate by telephone with an operator on the outside in the physiological laboratory.

Hard Coal Production Rises

WASHINGTON, D. C. — Anthracite production in 1941 totaled 56,368,267 net tons as compared with 51,484,640 tons in 1940, according to a report of the Pennsylvania Anthracite Industry issued by the Bureau of Mines.

Sixty-five and one-tenth percent of the total breaker shipments were in domestic size of ,which the most popular were chestnut (25.5%) and stove (24.3%). Buckwheat and other steam sizes accounted for 34.9% of the total breaker shipments of which buckwheat No. 1 amounted to 14.6%.

L.I. Stops Gas Heating

NEW YORK — A proposal by gas companies of the Long Island Lighting System to curtail the supply of gas for house-heating purposes to new customers, or for use in new equipment by present customers was approved August 13 by the State Public Service Commission.

The action was taken after companies in the group pointed out that fear among house occupants over the fuel-oil supply this winter had brought forth 325 unsolicited applications for heating by gas, with more applications expected.

St. Louis Smoke Ordinance Upheld by Missouri Supreme Court; City Can Regulate Smoke Nuisance by Any Reasonable Means

JEFFERSON CITY, MO. — Validity of St. Louis' smoke elimination ordinance, which has given that city two comparatively smokeless winters and attracted nationwide attention as a model for other cities, was unanimously upheld in a decision handed down here August 6 by the State Supreme Court.

In reaching its decision, the court overruled a number of attacks on the constitutionality of the municipal measure and also refused to order the release of a St. Louis resident sentenced to jail as a violator.

Written by Judge Ernest M. Tipton, the opinion held that Missouri law empowers St. Louis to regulate the smoke nuisance within its limits and to use any reasonable enforcement methods.

George W. Curran, St. Louis attorney and coal dealer, instituted the court test, the first since passage of the ordinance by the St. Louis Board of Aldermen in 1940. Curran represented B. R. Ballentine, who was sentenced to jail after refusing to pay a fine of $100 and costs last January on a charge of violating the measure by using unprocessed coal in a hand-fired stove.

Claiming that the ordinance violated various sections of the Federal and State Constitutions and the St. Louis charter, Mr. Curran asked the court to order Mr. Ballentine's release. As a result of the court's refusal, Mr. Ballentine, who had been free on $200 bond pending the decision, was left the choice of paying the fine or serving the sentence.

First discussed by the decision was Curran's argument that the ordinance was void because it is enforced by the City Division of Smoke Regulation and not the City Health Department. Curran contended Missouri law provides that smoke regulation be under the health department.

The court pointed out that that section of the state law applies only to cities of the first class, whereas St. Louis is not a city of any class, being governed by a special charter.

The first year following passage of the ordinance, it was noted, there was only 2.4% as much thick smoke as the year before, and in the second year there was only 1.87% as much thick smoke. The number and duration of moderate smoke palls also was drastically reduced.

It was further brought out that the ordinance was effective because of the way it was enforced and the basic principle of smoke elimination on which it rested, that St. Louis furnaces must burn either smokeless fuel or use mechanical burning equipment which can handle smoky fuels without the emission of dense smoke.

Observing that the State Legislature has provided that "the emission or discharge into the open air of dense smoke within the corporate limits of any city of the state is hereby declared to be a public nuisance," the court held that the only time a city cannot control the methods by which it enforces a smoke law is when the methods are "so arbitrary as to be violative of the constitutional rights of the citizens."

Curran's claim that the ordinance, by distinguishing between qualified and unqualified types of coal and heating apparatus, was illegal class legislation also was dismissed by the court. The coal which was illegal when burned in Mr. Ballentine's hand-fired furnace, it was noted, could have properly been used with a stoker, where it would have been spread more evenly in the firebox and produced less smoke.

Holding that he lacked the authority to raise them, the court refused to rule on two points advanced by Mr. Curran. In one instance, he claimed that the ordinance was unreasonable and void because it technically requires users of coal to analyze the contents of any coal they buy before buying it, and sellers of coal to determine if the prospective buyer has the proper equipment to burn the type of coal being sold.

The court pointed out it did not rule on this point because Mr. Ballentine was not charged with either of these hypothetical offenses. Judge Tipton did add, however, that the smoke ordinance authorizes the publishing of trade names or brands of approved fuels "for public guidance."

WPB Further Limits Heating

WASHINGTON—Two amendments to Limitation Order L-79, covering certain heating, plumbing, and cooking equipment, were issued August 11 by the War Production Board.

The first amendment includes in the terms of the order cooking and baking equipment using coal, oil or gas. Previously, only those types of cooking equipment connected to gas or steam systems were covered.

The other amendment includes the following gas-burning heating equipment in the terms of the order: steam and hot water heating boilers, warm air furnaces, floor furnaces, unit heaters, conversion burners, and gas steam radiators.

WPB Prosecutes Radiator Buyer

WASHINGTON — Criminal charges were filed July 27 by the Department of Justice, acting on behalf of WPB, against Waldo V. Tiscornia, Mayor of St. Joseph, Mich.

In the first action of this nature instigated by WPB, the defendant is charged with violation of the Second War Powers Act, which gives the force of law to all priorities orders and regulations and provides penalties running as high as one year in jail, a $10,000 fine, or both, for their violation.

Specifically, the offense charged against Mayor Tiscornia is that he violated the provision of Priorities Regulation No. 1 which requires that any person obtaining delivery of material as a result of a preference rating must use it for the purpose specified in connection with the issuance of the rating.

Facts in the case are stated by WPB to be as follows: Last April, Mr. Tiscornia instructed the Auto Specialties Manufacturing Co., of which he is vice-president and manager, to order in its own name approximately $800 worth of cast iron radiators and other heating supplies and to apply to the delivery of this equipment the A-10 rating provided for maintenance and repair material by Preference Rating Order P-100. WPB charges that the equipment was not intended for the permitted purposes of repair and maintenance by the company, but for installation in a new residence then under construction for Mr. Tiscornia's own use.

The materials were delivered under the rating, but information reached WPB's Compliance Branch in time to prevent their installation.

Swift Develops Beef Drying

NEW YORK—Swift & Co. has developed a continuous dehydration process for beef. The process, said to retain much of the attractiveness and flavor of the natural product, will be used in dehydrating 80,000 lb of beef recently ordered.

The new process, it was explained, is a continuous operation which involves precooking of cubed fresh beef at relatively low temperatures, immediately followed by grinding and slow drying. Temperatures are controlled throughout the operation and are low enough to permit further cooking of the dehydrated product in preparation for table use.

The dehydration and compressed packaging of beef will save up to 90% of the ship cargo space formerly used to carry and refrigerate fresh beef sides and quarters.

FHA Inaugurates 3-Point Campaign to Stimulate Modernizing for War-Worker Housing and for Fuel Conservation

WASHINGTON—Federal Housing Administration has initiated a campaign stressing three types of housing work permissible under existing regulations, and which can be financed through FHA's Title 1 Plan. The three types of work still financeable include (a) remodeling to house war workers, (b) repairs to maintain property, and (c) installations to conserve fuel.

Regarding remodeling for housing war workers, the program visualizes rehabilitation or alterations, extensions, or additions to provide additional living accommodations, for war workers. This type of work is authorized by WPB Orders L-41, PD-406 and PD-105.

Loans up to $5000, with terms as long as seven years, payable in monthly installments, are permitted. These being handled through any FHA-qualified lending institution. This work is to be done in designated defense housing areas only

On remodeling jobs having a total cost of less than $500 and where no critical materials are needed, work can be started without an authorization from WPB. Where the amount exceeds $500, an authorization to begin construction must be secured from WPB under Order L-41, even though no critical materials are involved.

When critical materials are required, application for them must be made on proper WPB forms, these being available at the nearest FHA office.

Regarding repairs to maintain property, FHA's Title 1 Plan permits loans up to $2500, payable in monthly installments. These terms, however, are subject to Federal Reserve Board Consumer Credit Regulation W. Loans authorized for this purpose are intended to cover work necessary to keep building in working condition, and the repair or restoration, without change of design, of any portion of a building which has become unfit for service. Work is authorized by WPB Order L-41. This work is authorized in all areas.

Under the third phase of the program, FHA's Title 1 Plan authorizes loans up to $2500 with terms up to three years, to be used as follows: (a) in the East, for conversion of oil burning plants to coal; (b) anywhere in the U. S. for general fuel conservation through the use of insulation, or other conservation measures.

The above are the three main channels through which FHA's Title 1 Plan operates to create war housing and further the Government's broad conservation program, as well as to ease as much as possible the situation of heating dealers and contractors.

Typical newspaper advertisements prepared by FHA for promoting various phases of construction.

Lockwood Greene Issues Brochure

NEW YORK—Lockwood Greene Engineers, Inc., 10 Rockefeller Plaza, has just issued a 118-page brochure outlining its engineering and appraisal services to industry and commerce. The book is largely pictorial and illustrates hundreds of projects which this firm has designed. Divided into sections, each of which is devoted to a particular type of industry or type of building, the book includes brief information on some of the outstanding plants in each category accompanied by a detailed list of plants in that category designed by the firm, with the result that the book is impressive both in volume and scope. One section is devoted to power plants exclusively. The book closes with a list of clients for whom the company does appraisal work.

170 Spaces Sold for Show

NEW YORK—A wide variety of timely displays will feature the 1942 National Power Show which is scheduled for Grand Central Palace, November 30 to December 5, and formally known as the 15th National Exposition of Power and Mechanical Engineering. The management announces that 170 spaces have already been definitely engaged by 137 concerns, and there will probably be at least 175 displays by the time the exposition opens.

Management is by International Exposition Company, Grand Central Palace, New York.

Rumors of Tank A.C. Persist

NEW YORK — Interest continues to be stirred both here and abroad by recurring reports concerning the use of air conditioning in tanks in Libya. Despite the tabling of a question in the British Parliament with the statement that no German tanks had been found so far with such equipment, rumors still have it that some German tanks are so equipped. One of the latest of these reports, as mentioned in the August issue of *Air Treatment Engineer* (London), quotes a French weekly newspaper which purports to give details of the air conditioning equipment which the enemy is using in North Africa.

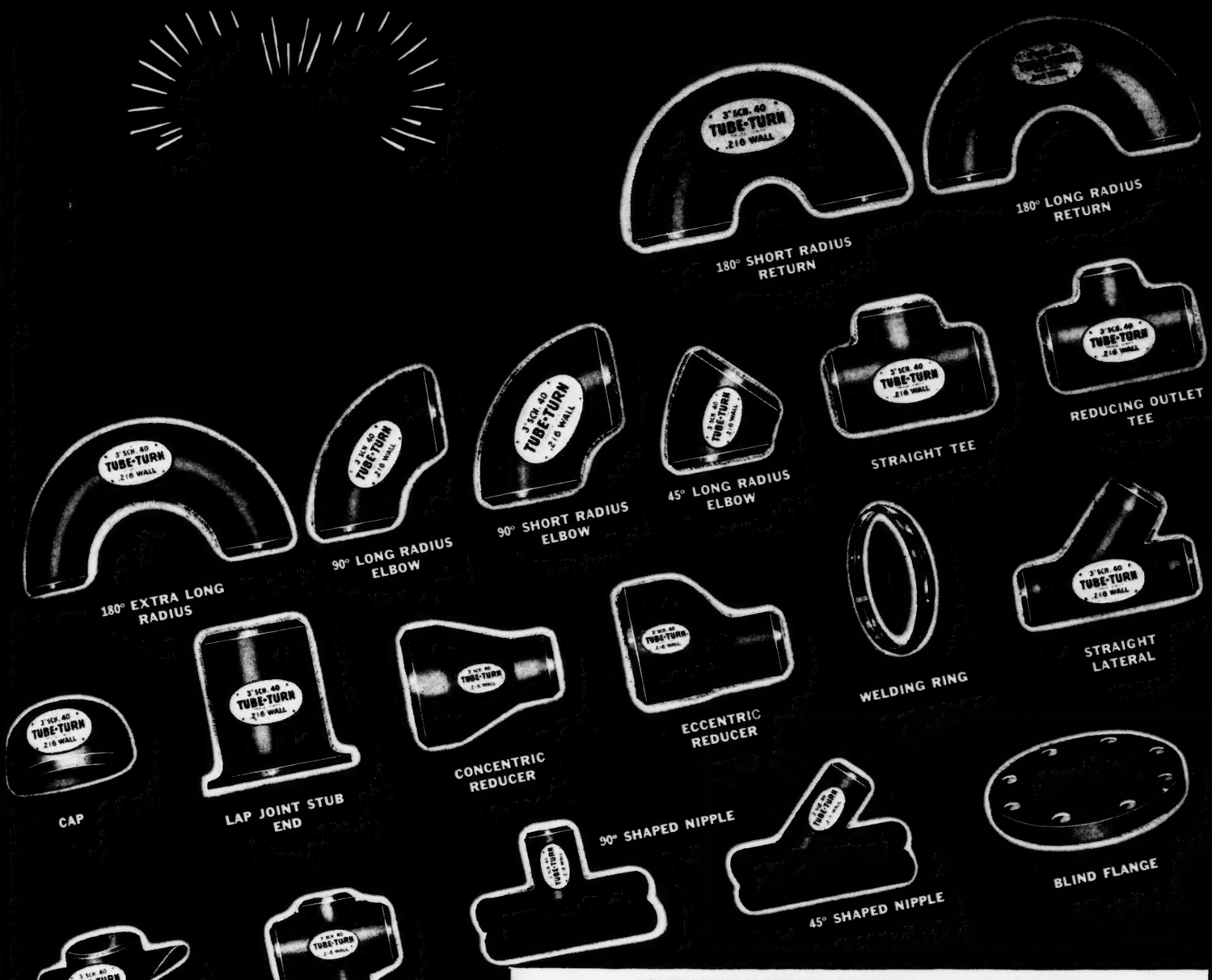
The supposed equipment has a compressor unit placed close to the wireless operator's seat in front of a partition which separates the operator from the tank engine compartment. The refrigerant is said to be methyl chloride with the condenser at the front of the tank. A propeller type fan in the engine compartment draws filtered air in at the front of the tank. According to the report, this refrigeration unit is capable of cooling to 68F from 120F but, as pointed out, such a performance is doubtful owing to the extremely large heat gains inevitable in a metal tank with the resultant necessity for extremely low air delivery temperatures from the cooling unit.

Also discussed is the possibility of making use of a waste heat boiler heated by engine exhaust gases to replace the mechanical compressor. In this way the hot exhaust pipe would vaporize the refrigerant at a determined temperature which could be controlled automatically and the principles of the absorption method of refrigeration could be applied.

Boyles Succeeds Tucker in St.Louis

ST. LOUIS—Robert M. Boyles, consulting engineer who in recent months has been supervising installation of production equipment at the St. Louis Ordnance plant, has been appointed city smoke commissioner to succeed Raymond R. Tucker, according to Mayor Becker.

It was announced that Mr. Boyles would take over the $6,000-a-year post of smoke commissioner Sept. 1, when Mr. Tucker was scheduled to resign to resume his full-time duties as head of the mechanical engineering department of the Washington University Engineering School. Except for a brief period, Mr. Tucker served as smoke commissioner since the enactment of the St. Louis smoke elimination law in 1940.



TUBE-TURN WELDING FITTINGS—RANGE OF SIZES

TYPE OF FITTING	DESCRIPTION	STANDARD WEIGHT	EXTRA STRONG	SCHEDULE 160	DOUBLE EXTRA STRONG
ELBOWS	90° LONG RADIUS	½"-24"	¾"-24"	1"-12"	1"-8"
ELBOWS	90° SHORT RADIUS	1"-24"	1½"-24"		
ELBOWS	45° LONG RADIUS	½"-24"	¾"-24"	1"-12"	1"-8"
RETURNS	180° LONG RADIUS	½"-24"	1"-24"	1"-12"	3"-8"
RETURNS	180° SHORT RADIUS	1"-24"	1½"-24"		
RETURNS	180° EXTRA LONG RADIUS	1"-2½"	1"-2½"		
TEES	STRAIGHT	¾"-24"	¾"-24"	1"-12"	1"-8"
TEES	REDUCING OUTLET	¾"-24"	¾"-24"	1"-12"	1"-8"
REDUCERS	Concentric and Eccentric	1x⅜"-24x20"	1x⅜"-24x20"		1x⅜"-12x10*
CAPS		1"-24"	1"-24"		1"-24"
STUB ENDS	LAP JOINT	1"-24"	1"-24"		
NIPPLES	Shaped, 90° or 45° to Header	1¼"-12"	1¼"-12"		
SADDLES		2"-24"			
LATERALS		1¼"-24"	1¼"-24"		
CROSSES		1¼"-24"	1¼"-24"		
RINGS		¾"-12"	1¼"-12"		
		150, 300, 400†, 600 and 900* Lb.		1500 Lb.	2500 Lb.
FLANGES	WELDING NECK	½"-24"		½"-24"	½"-12"
FLANGES	SLIP-ON	½"-24"		½"-12"	½"-12"
FLANGES	LAP JOINT	½"-24"		½"-24"	½"-12"
FLANGES	THREADED	½"-24"		½"-12"	½"-12"
FLANGES	BLIND	½"-24"		½"-24"	½"-12"

† Dimensions on sizes thru 3½" same as for 600 lb. flanges.

* Dimension on sizes thru 2½" same as for 1500 lb. flanges.

TUBE-TURN *Welding Fittings*

TRADE MARK

TUBE TURNS, INC., LOUISVILLE, KY. *Branch offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Tulsa, Houston, Los Angeles, Washington, D. C. *Distributors in all principal cities.*

★ The ★ FIRST WELDING FITTINGS 1ST AND STILL THE BEST

News of the Month

1942 Stoker Sales Off 21.5%

CHICAGO—Factory sales of mechanical coal stokers of all sizes and types for the first half of this year fell off 21½% as compared with the corresponding period in 1941, based on statistics furnished by 56 manufacturers reporting in June, 1942, to the U. S. Department of Commerce. Total factory sales for the first six months of 1942 were 52,816 units as against a total of 67,367 in the same period of last year.

Class 1 stokers (residential heating units with a capacity up to 60 lb of coal-feed per hour) accounted for all the decline in sales this year, due largely to the stopping of stoker sales activities on these sizes for several weeks last spring, resulting from an order of the War Production Board. This "freeze" order was later relaxed and sales of residential size stokers are permitted without priority ratings as long as dealer, distributor, and manufacturer stocks last.

U.S. Needs Operating Men

WASHINGTON—Enginemen (steam-electric) are needed to be in charge of heating, refrigerating, and ventilating systems in Federal buildings in Washington, according to the United States Civil Service Commission which is recruiting enginemen for positions paying from $1,680 to $2,040 a year.

Experience in the operation or installation of air-conditioning equipment will be accepted as qualifying. Applicants for all positions must show experience with electrical machinery. Experience in the operation of Diesel, air-conditioning, or refrigerating equipment is desirable, but not essential.

There is no education requirement nor age limits. Filing application forms, obtainable at first- and second-class post offices, is all that is necessary to be considered. Applications must be filed with the Civil Service Commission, Washington, D. C., and will be accepted until further notice.

Sees Big Post-War House Market

WASHINGTON — Heating installations in both new houses and replacements in existing homes will figure prominently in vast postwar purchases of goods to which the consumers of this country are even now looking forward, according to the findings of a preliminary survey by the United States Chamber of Commerce as announced here Aug. 8.

Approximately one in 30 of the families interviewed said they were planning to buy a new home.

Smoke Inspection for Indianapolis

INDIANAPOLIS — Modernization of city building code provisions covering the installation and operation of heating plants was recommended here Aug. 4 to the Board of Public Safety along with other drastic changes in the city's smoke abatement law.

Appointment of an advisory smoke control board of seven members and provision for the establishment of an annual inspection and fee-collecting plan also were included in the proposed amendments to the smoke abatement ordinance.

The recommended amendatory ordinance included three main divisions, the first providing for the seven-member advisory board. This board would keep itself informed of improvements in heating equipment and turn this information over to the Board of Public Safety to which all appeals would be made from decisions of the chief smoke inspector or the building commissioner.

Good reputation and five years' identification with the development and improvement of the city of Indianapolis could be general qualifications for advisory board membership. Specific qualifications, intended to assure representation of all interested groups, would be: An expert engaged in operation of apartment houses, hotels or office buildings; a chief operating engineer engaged in operating a high-pressure plant; a manager of a retail coal yard; an expert in the mining and sales of solid fuel who understands the theory of combustion; a licensed professional engineer engaged in designing heating and power plant equipment; and an expert in industrial and commercial enterprises. The seventh member would be the commissioner of buildings in an ex-officio capacity.

The recommended changes also would provide that all new plants over 1,200 sq ft of steam radiation or boilers of more than 12 hp or warm air furnaces with over 6 sq ft of grate area shall be of approved smokeless design or equipped for mechanical firing.

Rayhawk Heads New WPB Section

WASHINGTON—Appointment of Ronald Allwork, New York, as deputy chief of the Plumbing and Heating Branch of WPB was announced August 25.

The duties of the Planning and Projects Section will be consolidated under Arthur L. Rayhawk as chief of a new Production Requirements Section.

Indicates Need for Ventilation

LOUISVILLE — Indicating the likelihood of a broadened demand for industrial ventilating and air-conditioning installations in this state, Dr. Walter Doyle, director of the Bureau of Industrial Hygiene, State Board of Health, announced recently that a preliminary, cross-section survey of 226 Kentucky plants showed that organic dust, including silica, threatens the health of 10,822 workers in 91 plants.

The dusts and gases found, he said, are not necessarily present in dangerous amounts nor are all employes exposed to them.

Dr. Doyle said that definite analyses to determine the extent of health hazards in all Kentucky plants began about July 1. Due to the size of the job, he added, the immediate emphasis will be on plants engaged in war production.

"Both management and labor," he said, "are cooperating with us splendidly. Often employers call us in to determine causes of inefficiency and illness."

Urges State Sales Tax on A.C.

BOSTON — Threat of a state sales tax, which as proposed last year would have included air conditioning and heating equipment among a list of specified products singled out to carry the load, has once again been raised here.

State Tax Commissioner Henry F. Long revived the issue recently with the assertion that the sales tax is the only avenue of new revenue open to the state and that the State Legislature would have to consider new revenue unless it wanted to increase the present state tax assessment next year. He added, however, that he did not intend to campaign for a sales levy as he has in the past.

Air conditioning and oil and gas heating equipment sales, together with a long and varied list of other selected articles described as "luxuries," would have been taxed at 3% under a modified sales tax plan unsuccessfully urged upon the State Legislature last year by Commissioner Long.

Eavenson Heads B.C.R.

COLUMBUS — Howard N. Eavenson, Pittsburgh mining engineer and consultant, has been re-elected president of Bituminous Coal Research, Inc., the research agency of the bituminous coal industry and affiliate of the National Coal Association.

SAVING 350 TONS for—

TABULATION of Weights of one recent heating job showed that a Dravo Direct Fired system required 350 tons less of vital metals than would be required for a conventional heating plant!

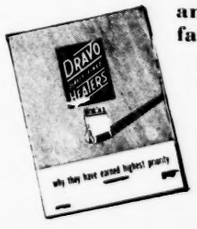
The men responsible for allocating critical materials for wartime building are recognizing many valuable innovations.

Traditional methods are being examined and frequently rejected in favor of more economical practices that have received recognition in the stress of this emergency.

A few years ago a steam plant and distributing system for heat were practically foregone conclusions when plans for industrial buildings were formulated.

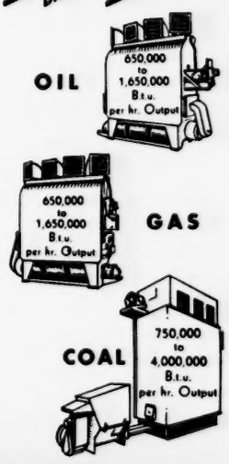
Today heat produced direct by Dravo Heaters has been proved to be more economical of materials—manhours—money—and time! It's easier to get materials when you can prove this!

Acceptance and increased use of the Dravo Direct Fired method of heating industrial buildings over the last 10 years merit the thoughtful consideration of anyone—architect—consultant—heating engineer—plant owner—purchasing agent—anyone who has anything to say about specifying or purchasing heating equipment for needed war production plants.



Complete description of construction and function of Dravo Direct Fired Heaters as well as comparison table showing savings they offer in weight, floor space and fuel consumption, will be found in Dravo Bulletin No. 506, available upon request.

DRAVO DIRECT FIRED HEATERS

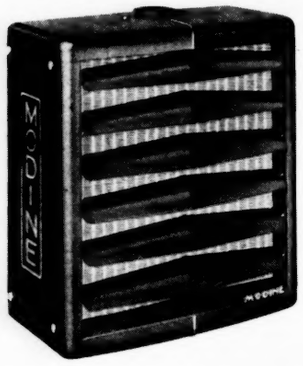


DRAVO CORPORATION

HEATER DEPARTMENT

DRAVO BUILDING — *Sales Offices in Principal Cities* — PITTSBURGH, PA.

NEW EQUIPMENT

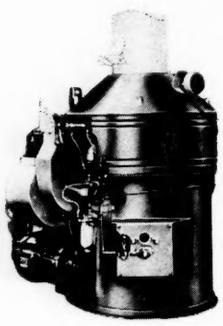


Steel-Condenser Unit Heaters

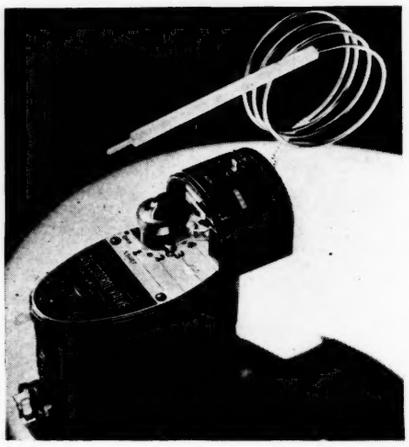
NAME — Style S/S steel condenser unit heaters.
PURPOSE—To conserve critical materials, used in typical unit heater applications.
FEATURES—In line with wartime metal conservation policies these heaters are steel-constructed, replacing the former non-ferrous construction. To obtain a maximum of corrosion resistance, ingot iron is used for condenser tubes and headers. Tube wall thickness is .065 in. The steel fins are permanently bonded with metal, and also mechanically bonded, to the tubes. After fabrication the condenser units are dipped in a lead alloy bath which gives final protection against corrosion.
MADE BY — *Modine Manufacturing Co., Racine, Wis.*

Steam Generator

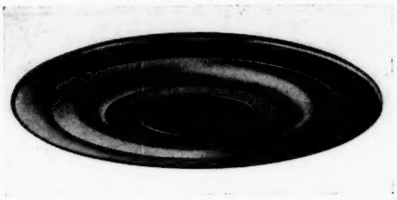
NAME—Package-Steam generator.
PURPOSE—For rapid generation of process and heating steam, especially in shipyard, industrial plant, airport, oil refinery, hospital and similar applications.
FEATURES — Consists of a boiler-like housing with air blower and burner, and a staggered steel tube coil heat exchanger assembly. A single motor drives all accessory units with air blower and fuel feed controlled by steam demand. The continuous coil construction used in the heat exchanger assures protection against explosion or escaping steam even though the generator may suffer severe external damage. This generator is said to produce steam from a cold start to pressures up to 300 lb in less than two minutes. Complies with ASME Code requirements and is supplied with standard boiler certificates.
SIZES AVAILABLE — Furnished in five standard units of 500 to 3000 lb evaporation per hr.
MADE BY—*Vapor Car Heating Co., Inc., 80 East Jackson Blvd., Chicago, Ill.*



Temperature Limit Control



NAME — A-P type U temperature limit control.
PURPOSE—For controlling the delivery air temperature for gravity fed oil burning heating units.
FEATURES—Consists of a charged thermo element, capillary tube, throttle and shut-off mechanism, and safety constant level oil control valves. The thermo element is placed either in furnace bonnet, or under floor grille, on floor type furnaces. Here the temperature in the bonnet or grille, acting through the thermo element, accurately controls high or low oil flow to the burner, or in case of abnormally high temperatures, shuts off the flow of oil by positive spring force. The control is made with a minimum of critical materials, and can be equipped for completely automatic operation through a wall thermostat by attachment of a special conversion set.
MADE BY — *Automatic Products Company, 2450 North 32nd Street, Milwaukee, Wis.*

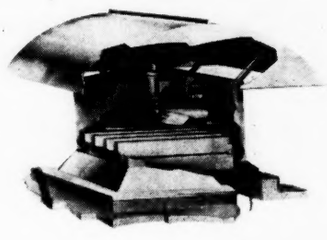


Air Diffuser and Exhauster

NAME — Venturi-Flo combination supply and return (or exhaust) unit.
PURPOSE—For supplying air into and exhausting it from enclosed places.
FEATURES—Air issues from an annular slot near the outside edge of the device and is diffused outward in all directions. Exhaust or return air leaves through the center section which is removable and consists of a series of concentric rings. A gasket around the outer edge forms a tight seal with the ceiling. This diffuser is applicable when the supply and return ductwork must be connected to a room at approximately the same point.
MADE BY—*Barber-Colman Company, Rockford, Ill.*

Industrial Roof Ventilators

NAME—War plant ventilators.
PURPOSE—For ventilation of industrial buildings under blackout conditions.
FEATURES — Consists of a heavy gauge black iron housing with hinged hood, propeller type fan and direct-connected totally enclosed motor; having a damper, automatically operated by a damper motor, and with internal electric connections. Casing painted inside and out with lustreless black enamel to meet blackout regulations. Hinged hood provides access to moving parts. Ventilators available in three types: (1) for exhausting fumes from the plant, (2) for supplying outside air to the inside of the plant and (3) for drawing in outside air and tempering.
SIZES—Each type available in capacities of 10,000, 15,000 and 20,000 cfm.
MADE BY — *Carrier Corporation, South Geddes St., Syracuse, N. Y.*



Looking for an efficient air cleaner?

WHEN IT COMES to efficiency, Fiberglas* Dust-Stop* Air Filters are aces high! They remove virtually all "nuisance" dusts harmful to varied manufacturing processes.

Dust-Stops are now at work in war production plants throughout the country. To many of these plants, the use of Dust-Stops means better, faster production . . . cleaner, more healthful working conditions, more accurate precision manufacture and fewer rejects, less time lost for plant clean-ups.

And Dust-Stops Bring You These Advantages

QUICK DELIVERIES: Made of 100% American materials, Dust-Stops are produced with no bottlenecks; distributors maintain ample stocks; deliveries are without delay!

CAPACITY: 2 CFM per square inch of area at 300 FPM.

RESISTANCE: Average resistance, new in inches of water gauge, .062 for 1-inch and .13 for 2-inch.

EASY TO CHANGE: Removing Dust-Stops requires no special skill or tools; it's as simple as changing your shoes, and quicker, too!

FIRE-SAFE: Dust-Stop's glass filtering material and non-combustible adhesive have been known to help stop the spread of fire.

ECONOMICAL: 1¢ per CFM to install, less than 1/10¢ per CFM to replace . . . that's all Dust-Stops cost. Further savings are possible when dust concentrations are heavy by cleaning them with a vacuum cleaner or by gently rapping out.

• • •

Order Dust-Stops from your air-conditioning manufacturer, jobber, dealer. *Or write us. Standard sizes available in No. 1 (1-inch thick), No. 2 (2-inches thick).*

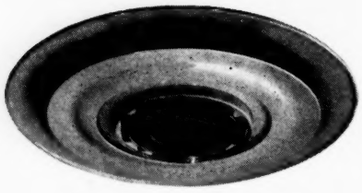
FIBERGLAS*

DUSTOP*

AIR FILTERS

*T. M. Reg. U. S. Pat. Off.

Made by Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, write to Fiberglas Canada, Ltd., Oshawa, Ontario.

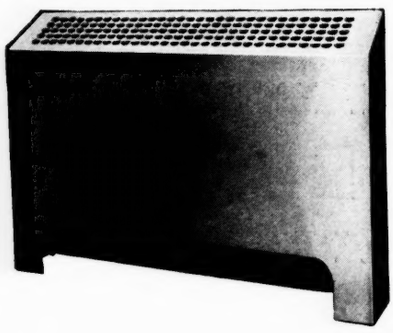


Automatic Air Diffuser

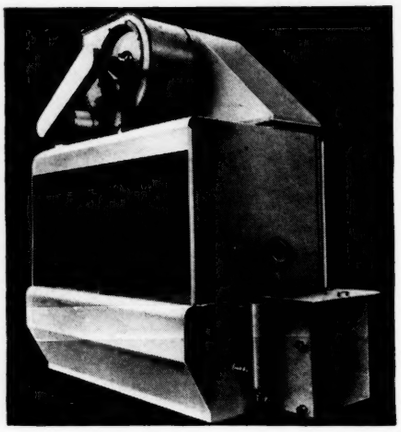
NAME — Thermostatically controlled Venturi-Flo air diffuser.
PURPOSE—For controlling the diffusion of air into conditioned spaces where ceilings are extremely high.
FEATURES — A thermostat in the supply duct controls the blades in a multivane damper located on the underside of the unit. When used for heating, the thermostat opens the blades allowing some of the warm supply air to be forced directly downward to the floor, which aids in eliminating high temperature gradients between ceiling and floor. When used for cooling, the dampers close and all of the air is diffused outward and downward in a conical pattern which covers the floor area served by the diffuser. When the air is at ventilating temperature, the damper assumes an intermediate position thereby forcing part of the air toward the floor.
LITERATURE—Bulletin No. F-1497-2.
MADE BY — *Barber-Colman Company, Rockford, Ill.*

Convector Cabinet

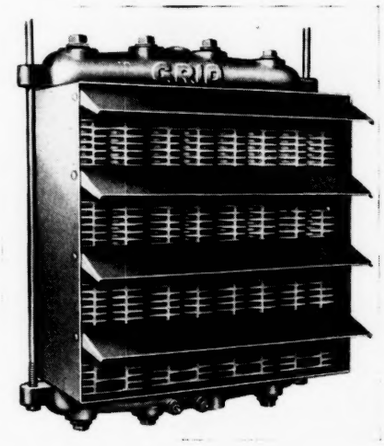
NAME — Mon-metallic cabinet convector.
PURPOSE—To be used in place of all-metallic convectors and radiators.
FEATURES — Designed to conserve critical materials, this convector unit has the cabinet constructed entirely of non-metallic material except for the screws. Side and top panels are made from rigid fibreboard and the supporting corner members of hard wood. Circular designed grilles are punched in the sloping top of the cabinet. Although the heating element of the convector unit is constructed of steel fins and tubes, the total amount of metal used in the complete unit is said to average only about one-fifth of that used in the ordinary radiator.
SIZES AVAILABLE—Two types, one for wall suspension and the other of the free-standing floor type.
MADE BY — *The Trane Company, La Crosse, Wis.*



Magnesium Grinding Booth



NAME — Hydro-Whirl magnesium booth.
PURPOSE — For the safe grinding, buffing, or polishing of magnesium parts.
FEATURES—Instead of being made of steel the grating on which the work rests is made of hard wood, which will not give off dangerous sparks if struck by the grinding wheel. As an added protection against fire, the booth sections are lined with Masonite. Water is maintained at a definite level in a tank below the grating, and any dust that does not drop directly into the water is trapped and washed out of the ventilating air by a water spray. The working mechanism consists of a rotating shaft on which is centered a series of discs. These discs throw a spray of water in a horizontal plane into a baffled section of the unit where the dust is whirled and scrubbed out of the air stream. Dust removal is said to be so thorough that the air may be returned to the building. The magnesium dust sludge taken from the bottom of the tank is either burned or buried in the ground.
MADE BY—*Industrial Sheet Metal Works, Detroit, Mich.*

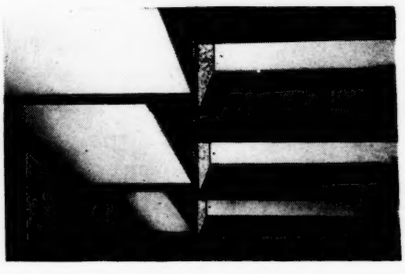


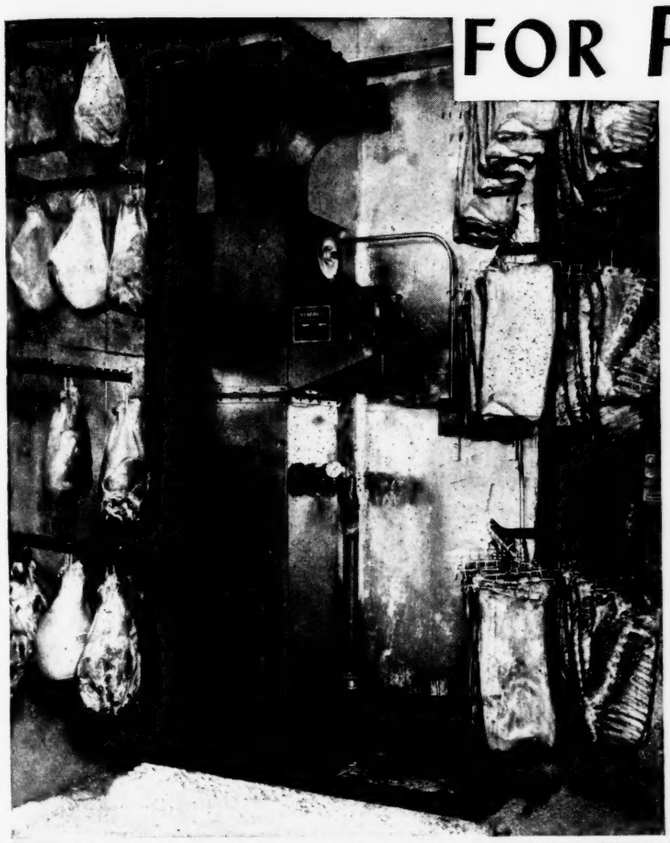
Cast Iron Unit Heater

NAME—"Grid" unit heater.
PURPOSE—For space heating. No critical materials used.
FEATURES — The War Production Board has permitted the substitution of cast iron for aluminum in the construction of the heating sections of this unit. With this single metal construction electrolysis is said to be eliminated, resulting in freedom from corrosion, leaks, and breakdowns, as only one metal comes in contact with steam or hot water.
SIZES AVAILABLE — Made in 8 sizes, good for pressures up to 250 lb steam.
MADE BY—*D. J. Murray Manufacturing Company, Wausau, Wis.*

Non-Metallic Ductwork

NAME—Sal-Mo supply duct.
PURPOSE — For warm air heating and air conditioning systems.
FEATURES—Used in place of metal for the straight portions of duct systems, leaving only standard fittings and connecting pieces made of metal, the resultant savings of critical metals said to approximate 90%. Can be used in residential installations carrying normal temperatures, in gravity or blower types, for entire return mains and for supply lines up to within 6 ft of the plenum chamber. By use of a special corner design, complete fabricated sections can be neatly folded and packed, thus permitting simple economical handling and storage.
MADE BY—*Sall Mountain Company, 176 West Adams Street, Chicago, Ill.*





FOR *Precise* CONTROL

of Temperature and Humidity in Moving Air the NIAGARA *Type A* SATURATING SPRAY CONDITIONER *is Most Trustworthy*

In processing hygroscopic materials or obtaining exact conditions for laboratory work, users find that this NIAGARA patented Saturating Spray Unit is most reliable, giving desired relative humidity to 1% tolerance and temperature to one degree.

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673 Ontario St., Buffalo, N. Y.
District Engineers in Principal Cities

NIAGARA *INDUSTRIAL* COOLING • HEATING • DRYING
HUMIDIFYING • AIR ENGINEERING *EQUIPMENT*

Degree-Day Handbook

• It is more than likely that the proposed fuel-oil rationing plan will be based on the degree-day. The Degree-Day Handbook is virtually encyclopedic in its scope, including comprehensive degree-day tables, with complete information on the use of the degree-day in predicting fuel consumption and on checking operating results.

CONTENTS

Temperature Terms Used by Weather Bureau
Symbols used in Formulas
What the Degree-Day is
Degree-Day (65° Base) in a Normal Heating Season
Degree-Days for Cities Near Weather Bureaus
Degree-Days for Recent Heating Seasons
Degree-Days for Industrial Heating
Heating Values of Fuels
Heat Equivalents for Steam and Electricity
Coal or Coke Required per Degree-Day
Oil Required per Degree-Day
Manufactured Gas Required per Degree-Day
Natural Gas Required per Degree-Day
Minimum, Maximum and Design Temperatures, and Heating Season Data
Figures Used in Predicting Fuel Consumption by the Fuel-Constant Method
Heat-carrying Capacities of Air Systems per Square Inch of Duct Area
Overall Seasonal Efficiencies of Various Types of Fuels
The Degree-Day as a Guide to Operating Efficiency
The Degree-Day in Customer Relations Work and Sales Promotion
Using the Degree-Day in Market Research
How the Base Temperature is Established
Use of Degree-Day in Predicting Fuel Consumption
Summer Cooling Data for 18 Cities.

298 pages — 30 illustrations — 29 tables. Price, $3

HEATING AND VENTILATING
148 Lafayette Street, New York, N.Y.

EXPLOSION-PROOF CONDENSATION PUMP UNITS delivered from stock!

Explosion-proof condensation pump units (either single or duplex) with capacities from 3,000 sq. ft. of radiation at 50 lbs. discharge pressure to 40,000 sq. ft. at 40 lbs. pressure. These explosion-proof units are all equipped with explosion-proof motors, starters, alternators, and conduit fittings.

Sterling Explosion-Proof Condensation Pump Units require 6 months to produce. We have a limited number in stock for immediate delivery. Write or wire for full specifications.

★ **REMEMBER...**
delivery from stock!

STERLING, Inc.
3732 North Holton St., MILWAUKEE, WIS.

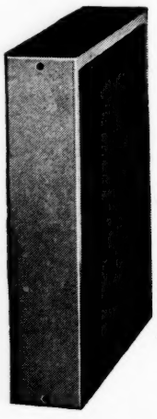
FIGURE YOUR AIR FILTER COST *by the year*

...not by the unit

Years of long life without need of replacements ... that's the secret of the economy of AIR-MAZE permanent washable air filters. Even though they cost a bit more *per unit* than conventional "throwaway" filter panels the difference in cost is usually made up in a year or less.

After that they still have a life expectancy of 10 to 15 years . . . all pure velvet on the cost side, except for the minor expense of occasional cleaning. For AIR-MAZE filter panels can be cleaned *again and again* to make them like new with all their original performance characteristics.

Add to this the advantage of their superior efficiency . . . *better than 99% by actual test* (practical dust) . . . and you have the important reason for the growing popularity of AIR-MAZE panels for every air filter need. *Approved by the Underwriters' Laboratories.*



Write for interesting data on the economy of AIR-MAZE air filter panels.

AIR-MAZE CORPORATION

5230 HARVARD AVE. CLEVELAND, OHIO

AIR-MAZE

DEPENDABLE AIR FILTERS FOR EVERY APPLICATION

DIRECT FIRED HEATERS

Dravo Corporation, Machinery Division, Heater Dept.
300 Penn Avenue, Pittsburgh, Pa.

Bulletin 506, standard size, 12 pages, illustrates and describes direct fired unit heaters for oil, gas or coal firing. The bulletin emphasizes the relatively small amounts of critical metals used in construction of the heaters.

RUBBER

B. F. Goodrich Company, Akron, Ohio.

A standard size, 12-page bulletin entitled, "Rubber Guide Book for American War Industries," lists the applications and properties of many types of products for industrial and aeronautical purposes, using natural, synthetic or reclaimed rubber.

AIR GRILLES

Barber-Colman Company, Rockford, Illinois.

Catalog F-1415-4 is standard size, 26 pages and describes the company's line of Uni-Flo sidewall grilles and registers and Venturi-Flo overhead air diffusers. Numerous illustrations show methods of applications.

VALVES

R-S Products Corporation
Wayne Junction, Philadelphia, Pa.

Bulletin No. 15-B, four pages, standard size, illustrates and describes heavy duty cast steel butterfly valves good for pressures of 150, 300, 600 lb respectively. Dimension tables included.

UNIT HEATERS

Modine Manufacturing Co., Racine, Wisconsin.

Two new standard size, 8-page bulletins giving complete engineering data on the company's new line of heaters having ingot iron tubes and headers. Bulletin 142 covers horizontal delivery heaters and bulletin 142B covers vertical delivery unit heaters.

WATER COOLERS

Young Radiator Company, Racine, Wisconsin.

Standard size, four page catalog No. 13638 gives descriptive matter, capacity tables, and operating performance of engine jacket water coolers used with gas, gasoline, diesel engines and compressor units.

PLASTICS

R. D. Werner Company, Inc.
380 Second Avenue, New York, N. Y.

A 16-page, pocket-size booklet, containing descriptive matter and general information on plastics. A table of general properties lists the principal attributes of six well-known plastics. Stock shapes are cataloged.

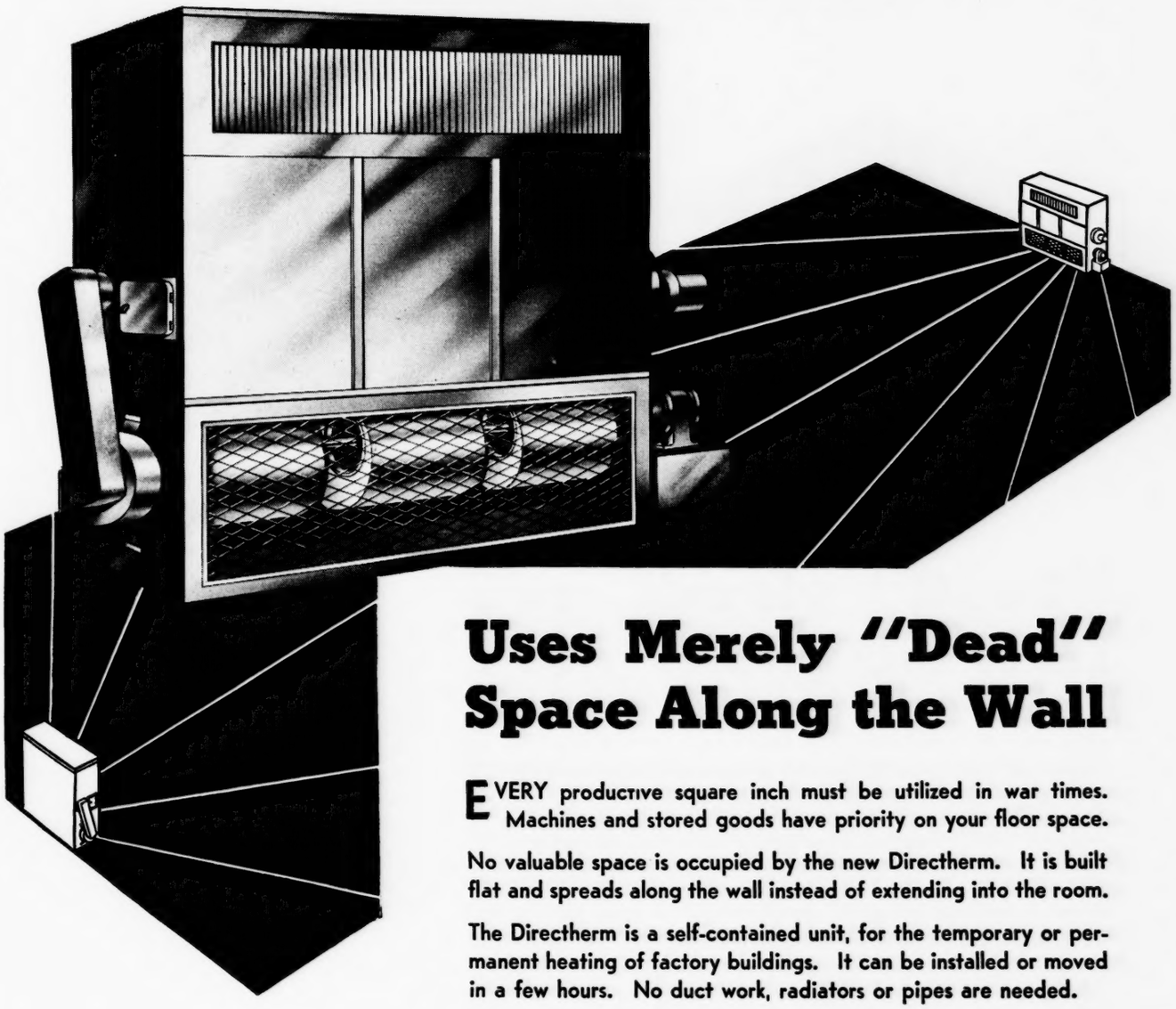
PRESSURE GAUGES

Certified Gauge and Instrument Corporation
34-18 Northern Boulevard, Long Island City, N. Y.

A standard size, 12-page catalog No. 4, illustrating and describing pressure, vacuum, and compound gauges including altitude and combination altitude and temperature pressure gauges.

THE NEW DIRECTHERM HEATER

SPACE-SAVER TYPE



Uses Merely "Dead" Space Along the Wall

EVERY productive square inch must be utilized in war times. Machines and stored goods have priority on your floor space.

No valuable space is occupied by the new Directherm. It is built flat and spreads along the wall instead of extending into the room.

The Directherm is a self-contained unit, for the temporary or permanent heating of factory buildings. It can be installed or moved in a few hours. No duct work, radiators or pipes are needed.

Eighty percent of the invested fuel energy is converted to heat, which is cast into the room as far away as 200 feet. That is economy!

For oil or gas fuel. Made in 3 standard sizes (750,000-1,700,000 BTU). Standard Directherm Heaters in 6 sizes (300,000-1,700,000 BTU) for coal, oil or gas fuel.

AIRTHERM
MANUFACTURING COMPANY

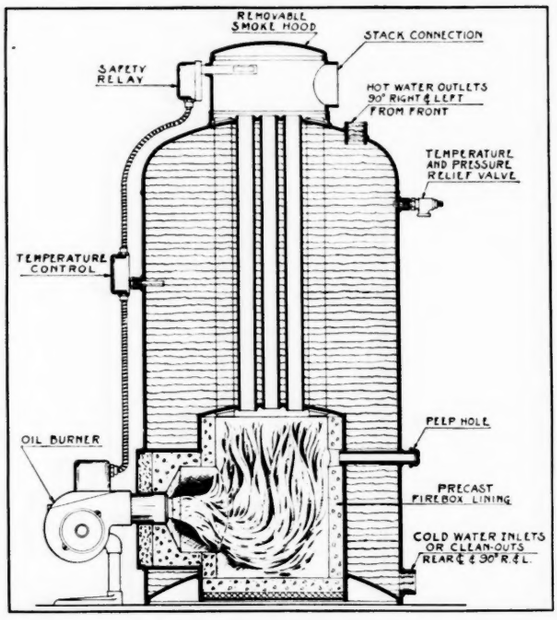
722 S. SPRING AVE., ST. LOUIS, MO.

Hot water for hundreds of men from this new, heavy-duty water heater

built by

JOHNSON

270 g. p. h. capacity. — 230 gallon self-storage tank.—Not insulated nor galvanized.


REMOVABLE SMOKE HOOD
STACK CONNECTION
SAFETY RELAY
HOT WATER OUTLETS 90° RIGHT & LEFT FROM FRONT
TEMPERATURE AND PRESSURE RELIEF VALVE
TEMPERATURE CONTROL
PEEP HOLE
OIL BURNER
PRECAST FIREBOX LINING
COLD WATER INLETS OR CLEAN-OUTS REAR ℄ & 90° R. & L.

The AQULUX-225

. . . for Army Barracks, Mess Halls, Bathing Facilities, Hospitals, Dormitories, War Industries.

Here's the answer to a wartime need . . . a fully automatic water heater that delivers 270 gallons per hour . . . that consumes a minimum of fuel . . . that is built with a minimum of critical materials.

It has the famous Johnson Bankheat Burner with 225,000 btu output to insure high recovery and large volume . . . a burner which carries the Underwriters' and Commercial Standard Label for safety and performance.

The 230 gallon tank is not insulated, nor galvanized, nor encased in a steel jacket (except on special order). In these and other ways, the use of essential materials has been cut to a minimum without sacrificing efficiency or safety.

It is built of black steel plates, electric arc welded; extra heavy steel fire-tubes; and precast refractory lined combustion chamber for oil or gas fuel. Temperature and pressure relief and drain valve are standard equipment. It requires little floor space. Installation is simple and inexpensive.

May we send you the complete data on this wartime "big brother" of the widely known Aqulux-85 and 150 models? Or on the still larger, standard Johnson heaters with capacities up to 600 g.p.h. and special units which we can build to your particular specifications? We'll send it gladly.

S. T. JOHNSON CO.

40 years experience in the Engineering and Building of Fuel Oil Equipment

940 Arlington Ave.
Oakland, California

401 No. Broad St.
Philadelphia, Pa.

WITH THE MANUFACTURERS

ENERGY CONTROL CO.

has been appointed by Cochrane Corp., Philadelphia, as flow meter representative, for eastern Pennsylvania, southern New Jersey, Delaware and Maryland. Energy Control Company is located at 3107 No. Broad Street, Philadelphia, and will also handle Hays combustion control and instruments and the Heacon damper. Energy Control also represent these lines in New York City and vicinity, including western Connecticut and northern New Jersey.

THE INDUSTRIAL OVEN ENGINEERING CO.

Granada Building, 11621 Detroit Ave., Cleveland, Ohio, has been organized to take over the contract engineering work and automatic equipment design work formerly handled by the Industrial Oven Engineering Division of The Metal Equipment Company. The new company consists basically of the old organization, plus a contract engineering department specializing in material handling and special process engineering. The chief engineer of the new organization is C. A. Litzler.

JAS. P. MARSH CORPORATION

announces that the name of its subsidiary has been changed from the E. A. Hill Company, Inc., to Dependable Manufacturing Company, Division of Jas. P. Marsh Corporation. General offices are located at 2073 Southport Ave. with factory operations at 430 West Erie St., Chicago. Dependable Manufacturing Company is engaged exclusively in the production of tools used in the manufacture of armaments.

SALEM ENGINEERING CO.,

Salem, Ohio, has purchased the Tolerton Engineering Company of Youngstown, Ohio. Salem will maintain the offices of Tolerton at 813 Market Street, Youngstown, operating it as a subsidiary company. The new division of Salem will sell, manufacture, and install locker storage systems, fast freeze units and air conditioning and refrigeration units, both process and commercial. O. R. Tolerton, formerly president of Tolerton, has been named manager of the new air conditioning and refrigeration division.

PACIFIC-AIRMAX CORP.

has been formed by a merger of Airmax Corp., San Diego, Calif., manufacturers of aircraft heating equipment, with Pacific Gas Radiator Co., Huntington Park, Calif. All Airmax products will now be manufactured in the Pacific plant at Huntington Park, where general offices of Pacific-Airmax will be located. Officers of Pacific-Airmax Corporation include: Helen A. Hartfield, president; R. C. Gross, vice president and general manager; Helen A. Wilke, secretary and treasurer; L. M. Hull, sales manager; A. A. Arnhym, chief engineer; E. M. Rahm, works manager and J. B. Marchand, purchasing agent.

YORK ICE MACHINERY CORP.

has moved its Pittsburgh branch to the Hostetter Building, 7 Ferry Street, Pittsburgh.

CARRIER CORPORATION,

Syracuse, N. Y., has appointed Harold L. Rowland to its administrative staff, according to an announcement by Cloud Wampler, president. Mr. Rowland has had a broad experience in business and financial fields. He is resigning as president and director of George F. Getty, Inc., vice-president, treasurer and director of the Pacific Western Oil Corporation, vice-president of the Mission Corporation, and president and managing director of the Hotel Pierre, New York.

PERSONALS AND PERSONNEL

RALPH B. MEISENHELDER

assistant to the president of York Ice Machinery Corp., has been appointed director of war contract progress. Duties will consist of coordination and liaison responsibilities within the sales, engineering, manufacturing, administrative and war material divisions.

S. E. LAUER

president of the York Ice Machinery Corporation, was elected a director of the American Management Association at its recent annual meeting in New York.

WHAT READERS SAY

WICKING ON PIPE THREADS

EDITOR HEATING AND VENTILATING:

In the May, 1942, issue of HEATING AND VENTILATING is a short note on "Use of Wicking in Pipe Thread Joints."

In ordinary times millions of pounds of brass pipe are made for commercial uses and it has been observed that the use of wicking to make up pipe thread joints is poor practice and should be discouraged.

That practice leads to carelessness in cutting threads, and although threaded joints in brass pipe may be made tight with wicking at the time they are tested for acceptance, they can cause endless trouble in a few years.

It is not at all uncommon to find that the water finally follows the wicking and slowly seeps through, with evidence of leaks from the deposit which forms by the evaporating water. When that occurs, the pipe becomes corroded on the outside, where there is air (oxygen) to increase corrosion, at a rate out of all proportion to the corrosion which may be found inside the pipe.

I remember a case where after one year nearly all the brass pipe joints in an apartment house were leaking seriously and pipe ends were corroded where wicking was very much in evidence, while in the same town another installation of the same grade of pipe, where no wicking was used, was sound after about ten years' service.

Another thing which irks the writer is the statement that "in Germany the mechanics wick all iron pipe and brass pipe threads." Are not American mechanics as skillful as German mechanics? Americans can make the best pipe joints without wicking regardless of what the Germans may do.

F. G. Smith.

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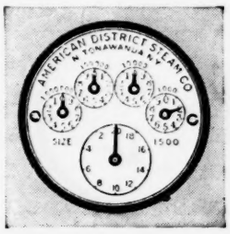

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SUMMER DEGREE HOURS (Above 85F) JULY, 1942

There is some evidence that the summer air conditioning load in residences is roughly proportional to the number of summer degree hours above 85F. For that reason HEATING AND VENTILATING has been compiling and recording these data for a number of years. The following table covers these data for July, 1942

City	Number of Degree-Hours July, 1942	Number of Degree-Hours Summer, 1942 to July 31
Baltimore	678	937
Birmingham	872	1469
Bismarck	65	70
Boston	124	197
Buffalo	0	12
Chicago	466	687
Cincinnati	365	582
Cleveland	313	434
Columbus	466	799
Des Moines	413	673
Detroit	336	418
Fort Wayne	264	444
Houston	806	1661
Indianapolis	504	885
Memphis	1557	2457
Milwaukee	240	262
Minneapolis	244	259
New Orleans	874	1463
New York	143	167
Oklahoma City	1461	2088
Philadelphia	324	476
Pittsburgh	187	284
Portland	431	588
Richmond	876	1399
St. Louis	939	1392
San Francisco	0	9
Savannah	1710	2381
Toledo	309	485
Washington	635	1015

These figures are computed from data made available through the cooperation of the U. S. Weather Bureau.

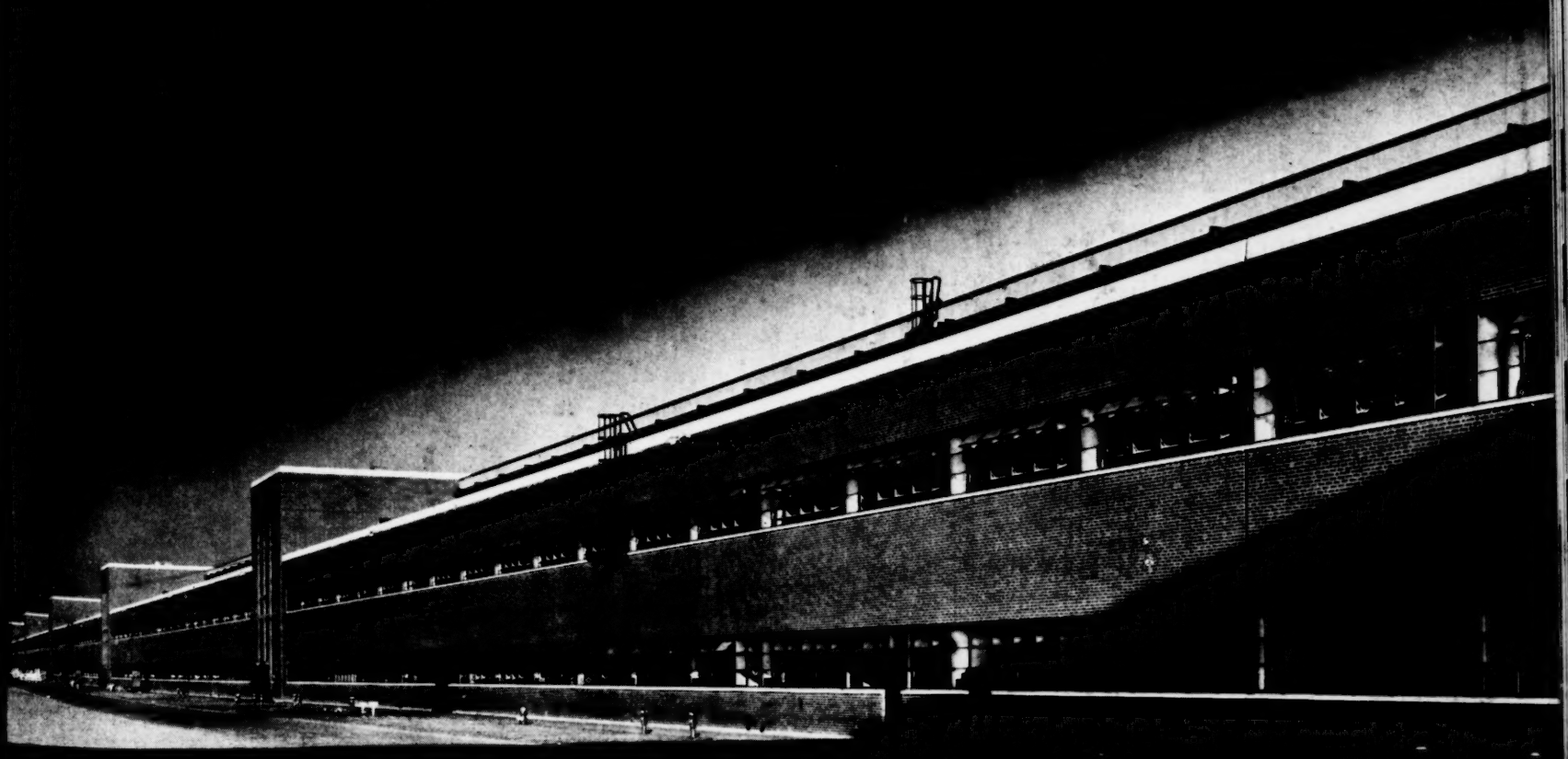
COMING EVENTS

NOVEMBER 24-29—War-Time Chemical Show and Exposition, to be held at the Hotel Sherman, Chicago, Illinois. Further information from Marcus W. Hinson, manager of the exposition, National Chemical Exposition, 110 No. Franklin Street, Chicago, Illinois.

NOV. 30-DEC. 5. 15th National Exposition of Power and Mechanical Engineering at the 1942 National Power Show to be held at Grand Central Palace. Management is by International Exposition Co., headquarters at Grand Central Palace, New York.

H&V's PHOTOS

Pages 27-29. Westinghouse Electric & Mfg. Co.
Page 30. Babcock & Wilcox Co., Inc.
Page 31. (Top) Babcock & Wilcox Co., Inc.
Page 31. (Lower right) Lincoln Electric Company.
Pages 35-36. Sutter Camera Service, Burlington, Iowa.
Page 39. Official U. S. Navy Photograph.
Page 40. American Society of Agricultural Engineers, Saint Joseph, Mich.
Page 42. Glenn L. Martin Co., Baltimore, Md.
Page 49. Cork Insulation Company, New York, N. Y.
Page 50. Johns-Manville, New York, N. Y.

HEATING AND VENTILATING

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